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NAME OF AUTHOR/*NOM DE L'AUTEUR* FODOR, VIOLA

TITLE OF THESIS/*TITRE DE LA THÈSE* A COMPARISON OF TWO METHODS OF TEACHING NUTRITION EDUCATION

UNIVERSITY/*UNIVERSITÉ* UNIVERSITY OF ALBERTA

DEGREE FOR WHICH THESIS WAS PRESENTED/ *GRADE POUR LEQUEL CETTE THÈSE FUT PRÉSENTÉE* M.ED.

YEAR THIS DEGREE CONFERRED/*ANNÉE D'OBTENTION DE CE GRADE* 1979

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UNIVERSITY OF ALBERTA

A COMPARISON OF TWO METHODS OF TEACHING NUTRITION EDUCATION

© VIOLA FODOR

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE

OF MASTER OF EDUCATION

DEPARTMENT OF EDUCATIONAL PSYCHOLOGY

EDMONTON, ALBERTA

FALL 1979

UNIVERSITY OF ALBERTA

FACULTY OF GRADUATE STUDIES

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a thesis entitled

A COMPARISON OF TWO METHODS
OF TEACHING NUTRITION EDUCATION

submitted by Viola Fodor
in partial fulfillment of the requirements for the degree of
Master of Education.

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Date May 31, 1979

ABSTRACT

This study compared two methods of nutritional instruction (called A and B) to identify instructional methods that facilitate gains in knowledge of appropriate nutritional behaviors. In treatment A, students were taught by the "Big Ideas" instructional approach. The teaching was supplemented with food samples which the children could taste. In treatment B, students were taught by the "Big Ideas" approach and were exposed to numerous multi-media learning activities but did not receive food samples for tasting. A control group (C) receiving no nutritional instruction was included.

Separate instruments were developed to test knowledge gain at each grade level. These were pilot-tested, and checked for content validity by experts. For data collection purposes, a two-stage sample was designed. The first stage consisted of randomly selecting schools from the lists of schools offering treatment A or B, or no treatment (C). At any selected school, all grades from 1 to 6 were then included in the second-stage sample. For the second stage, 10 questionnaires were selected at random from both the pre- and posttest returns of each class. In this way, independent pre- and posttest data became available for 757 Alberta children. Responses were coded, and analyzed by Analysis of Variance.

Results showed that treatment A - nutrition education supported by food samples - increased nutritional knowledge of children in all grades. In grades 2, 3, 4 and 6, this gain was

statistically significant at the 0.05 level. Students in treatment B - nutrition education supported by multi-media resources - showed no significant knowledge gains in relation to those in the control group at any grade level.

It was concluded that treatment A was more effective than treatment B in increasing nutritional knowledge of elementary school children. The disappointing influence of treatment B was partly attributed to its less systematic administration when compared to treatment A.

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CHAPTER I

THE PROBLEM AND ITS BACKGROUND

INTRODUCTION

Children do not grow, live, and learn in a vacuum. They are influenced by their everyday environments. It might be expected that in developed countries like Canada and the United States environmental measures would be taken to ensure that children develop physically, mentally, and emotionally to optimal levels. Unfortunately, this is not the case. In the health field, nutrition is neglected as an important factor in the optimal development of children. Children are not eating as well as they could be and are not gaining full nutritional benefit (Nutrition Canada Survey Report, 1973). An official of the United States Department of Agriculture (Hill, 1972, pp. 257-258) summed it up this way:

> We like to visualize the healthy child eagerly approaching his new adventure - his first day in school. His eyes are bright and clear, his hair has the luster associated with health, and his skin glows. He is sturdy and alert, bright and inquisitive. We picture an energetic, happy youngster who has developed physically and mentally to the point where he is ready to study, work, and play with other children under the direction of a teacher in school.
>
> Unfortunately, this description does not apply to all children. Some children are listless, with dulled eyes, hair and skin. The growth of some has been limited; others are frail and become fatigued so easily they cannot participate fully in the activities that promote mental and physical development.

> We have valid information to indicate that food makes a difference in how our children grow and develop; how they look and feel; how energetically they can work and play; and how long and effectively they can expect to live. We also know enough about the science of nutrition to advise our people how to select food wisely. Our food supply is such that if distributed equitably individuals could have an adequate diet.

There is little excuse for nutritional deficiencies among children in surplus food countries like Canada or the United States where sufficient knowledge to avoid nutritional problems is easily available. However, improperly fed school children exist in sufficient quantity to arouse concern.

Research on nutritional status and food consumption indicates that far too many children and adults at all socioeconomic levels have poor diets (Schaefer, 1969; Nutrition Canada Survey Report, 1973). While a small number of Canadians are too poor to maintain acceptable levels of nutrient intake, others lack the basic nutritional knowledge that would permit them to make good nutritional food choices. Still others have some basic nutritional knowledge but fail to apply the knowledge in their daily food habits (Fremes and Sabry, 1976). It is clear that poor nutritional status is not a consequence of poverty alone. Poor diets are frequently a consequence of ignorance of nutritional requirements, misinformation, or may involve a more complex matrix of attitudes and psychological needs (Livingston, 1971; Cordell & Giebler, 1977).

Dietary patterns may be nutritionally good or bad, but whatever the case, they are essentially learned. Just as people can learn to be indifferent in their food selection, so can they learn to select foods which contribute positively to their nutritional requirements (Weininger & Briggs, 1976; Stronk, 1976). But this is no easy process. In a technological society, many influences mitigate against an individual's development of positive eating habits. The move from rural to urban centers, the growing convenience food market, and the advertising media are only a few of these influences.

Many Canadians could benefit from a program of nutrition education. Elliott (1966) describes the aim of such a program: "to help ... develop good (eating) habits and attitudes as a foundation for happy successful living" (p. 41). However, achieving this goal would require more than simple dissemination of nutritional knowledge (Houts, 1974). As well as providing for an understanding of nutritional information, an effective program might attempt to develop wholesome attitudes toward food by providing the individual with opportunities to practice good nutritional choices. In a learning situation, for instance, the tasting of the advocated food within the context of a meaningful program may leave a more sustained, positive effect on behavior (Capuano, 1977).

Although nutrition education is of vital concern for every individual, it should begin with the young. Many food habits and attitudes are developed early in life. Once formed, they resist change or modification. Therefore, it is preferable to establish good eating habits early in life rather than attempt to modify poor eating habits later (Hill, 1969;

Beyer & Morris, 1974; Kerry, Crispin, Fox, & Kies, 1968).

PURPOSE OF THE STUDY

The Nutrition Canada study (1973) found over 60% of Canadian school children to have improperly balanced diets (see Table 1). In view of the distressing number of children reported to be suffering from poor or improper nutrition, a significant challenge existed for schools to initiate effective programs of nutrition education for children (King, 1976).

This study compared two possible alternatives of providing such a nutrition education program. The effectiveness of each alternative was measured relative to changes in the students' nutritional knowledge. A control group was included in the study to assess non-treatment effects between pre- and posttests.

One of the two nutrition education programs compared here employed food samples which the students could taste during the discussion of the merits of that particular food item. The other program relied on classroom discussion supported by ample audio-visual materials.

Based on the operant conditioning model (Skinner, 1938), it was hypothesized that the practice of the advocated behavior provided by tasting the foods under discussion would provide primary reinforcement of the desired behavior, and, therefore, would more effectively influence retention

TABLE 1

DIETARY EVALUATION OF CHILDREN* (5-9 YEARS OLD) PERCENTAGES WITH LESS-THAN-ADEQUATE AND INADEQUATE INTAKES OF NUTRIENTS

NUTRIENT	LESS-THAN-ADEQUATE	INADEQUATE
Protein	2.9	0.1
Iron	21.6	13.9
Calcium	28.9	14.8
Potential Vitamin D	50.8	23.4
Vitamin A	12.7	5.0
Vitamin C	12.3	2.2
Thiamin	21.9	1.3
Riboflavin	9.2	1.1
Niacin	1.5	0.3

* Residents in provinces exclusive of Indians in bands living on reserves and Eskimos in settlements.

Adapted from Nutrition Canada Survey Report, 1973, Table 5-6, p. 69.

of nutritional knowledge than the secondary reinforcements (for example, social approval) provided by a teacher in an audio-visually enriched but otherwise traditional learning environment. It was further hypothesized that the traditional instruction method using extensive audio-visual resources would be more effective in altering students' nutritional knowledge than mere maturation as experienced by the control group.

In summary, the availability of both nutritional and junk foods creates a situation where more appropriately balanced diets can be achieved by informed and intelligent choices among the various foods available. Schools can play a significant role to diminish the frequency of improper diets by teaching about nutrition. The effectiveness of two methods of teaching a nutrition program was compared in this study. In the first method, children were provided with food samples to taste the foods under discussion, while in the second method, children were taught in an enriched learning environment supported by films, games, and books, without the food samples. Two hypotheses were tested: (1) that the food samples method is superior to the enriched environment method in increasing nutritional knowledge, and (2) that the enriched environment method is superior to no discussion of foods in increasing nutritional knowledge of students.

CHAPTER II

REVIEW OF RELATED RESEARCH

THE ROLE OF NUTRITION TO NORMAL DEVELOPMENT

Definition of Nutrition and Its Relation to Body Growth

Nutrition is defined as "the science of food and its relation to health" (Stare, 1969, p. 135). Closely related to physiology and biochemistry, nutrition is:

> that science which deals with the identity and function of those substances in food and water required by an organism for growth, maintenance, and reproduction; with the foodstuffs which enable the organism to meet these; and with factors involved in the consumption and utilization of such foodstuffs by the individual.
> (Briggs, 1969, p. 7)

Food consumed provides energy and nutrients for normal growth. Among other things, good nutrition is essential for normal brain development and skeletal growth, hormone synthesis and sexual development, resistence to disease and recovery from infection, and the ability to tolerate stress (National Council of Welfare, 1973). "By its very nature, nutrition is developmental" (Ford, 1974, p. 10). Food provides the building blocks for individual growth and development, and helps to provide "the foundation for effective intellectual, psychological, and social development and functioning" (ibid.).

If nutrient intake is not adequate to meet individual needs, the normal growth pattern can be interrupted (Birch, 1972). The specific effects of any nutrient deprivation will depend on the severity of the deprivation, the duration of the deprivation, and the age at which the deprivation occurs (Leverton, 1969; Raman, 1975).

THE EXTENT AND CONSEQUENCES OF MALNUTRITION

Definition of Malnutrition

The terms "malnutrition" and "hunger" have been used interchangeably by some, but they are not synonymous (Birch, 1972). Malnutrition is a physiological condition that results in a change in normal body structure or performance. It involves a chemical imbalance between the supply of nutrients and the body's need for them. The term "malnutrition" may be characterized by excesses of food intake (overnutrition), deficits of food (undernutrition), or dietary deficiencies of one or more nutrients that are essential for health (Anonymous, Nutrition Problems Today, 1972). To illustrate, a dietary intake of calories or saturated fats or vitamin A, in excess of body requirements, is a form of "malnutrition" with possible consequences. So is a dietary deficit in protein, vitamin C, or total calorie intake.

The effect of hunger on the body is different. Unlike malnutrition, hunger imposes a stress on the individual which can be rapidly relieved with food (Subcommittee on Nutrition, Brain Development and Behavior, 1973). While hunger has both physiological and psychological components, "it does not permanently alter neurological structures" (ibid., p. 245) or cause any other permanent organic changes. The effects of malnutrition, on the other hand, may require prolonged rehabilitation and have more lasting consequences.

Consequences of Malnutrition

Malnutrition can affect any aspect of human functioning - physical, mental, or emotional. It can cause severe or subtle, permanent or reversible damage (Cravioto, Delicardie, & Birch, 1966; National Council of Welfare, 1973). Poorly nourished mothers are far more likely to give birth to premature (low weight) babies than other women. Low birth weight is related to increased rate of still birth, neonatal death, poor infant development, cerebral palsy, mental retardation, and lowered intelligence (Singer, Westphal, & Niswander, 1968). Improperly balanced diets or eating patterns can cause or aggrevate numerous physical conditions: cardiovascular disease, hypertension, anemia, various gastrointestinal problems, dental caries, and obesity (Sabry, 1975; McGovern Report Committee, 1977; Interdisciplinary Cluster on Nutrition, 1977). Even moderate malnutrition, resulting from borderline or mildly inadequate intake of certain nutrients, can be the cause of apathy, fatigue, reduced ability to concentrate, poorer coordination of motor activities, and reduced ability to deal with one's environment (Stewart, 1971; National Council of Welfare, 1973).

Relationship Between Malnutrition and Learning

Brain cells need nourishment like other body cells (Subcommittee on Nutrition, Brain Development and Behavior, 1973). They are especially vulnerable to nutritional insult during the period that extends from four months before until two years after birth. If brain cells are deprived of essential nutrients during this time, the brain can be permanently damaged. The result is mental retardation (Lewin, 1975). Even after this early stage, nutrition continues to be a critical factor in the development of learning capacities. However, when insult does occur, there is a shift in the nature of the damage (National Council of Welfare, 1973), as follows.

Learning is sequential - each new stage is built upon the foundations of the previous stage (Piaget & Inhelder, 1969; Montessori, 1964). Malnutrition can produce interferences with this learning sequence, especially during critical periods of development (Shneour & Shneour, 1977). Typical symptoms of moderate malnutrition include fatigue, apathy, irritability, and depression. These symptoms can interfere with a child's capacity to attend to a structured learning experience (Saadeh, 1974; Raman, 1975). They can interfere with a child's ability to play, and as Bruner (1975) has stated, play is "serious business" for the child. Not only does play help the child to "assimilate experiences to his personal schema of the world" (p. 83), it is desirable for the socialization of the child. Malnutrition can also reduce a child's resistence to infection and disease. A child's whose resistance is low is likely to be absent frequently from school. This will further remove the child from the learning situation and isolate the child from friends (National Council of Welfare, 1973).

Hill (1972) has stated that "inadequate nutrition is an obstacle to learning" (p. 258). He and others are concerned that educators frequently overlook the significance of this statement. "It is perplexing that (some educators) consider their responsibility is to educate children and yet ignore the effects of proper nutrition upon the child's ability to learn" (Schaefer, 1971).

The Nutrition Problem in Canada

Severe malnutrition is portrayed as a problem of developing countries. Often unrecognized is a shocking degree of malnutrition in technologically advanced societies (Schaefer, 1971; Sabry, 1975; Interdisciplinary Cluster on Nutrition, 1977). In Canada's poor population, severe nutritional problems have been reported among children (Adams, Cameron, & Hill, 1971; Corporation of Professional Social Workers of the Province of Quebec, 1970; Perkins, 1975), pregnant women (Higgins, Crampton, & Moxley, 1972), and elderly people (Special Senate Committee on Poverty, 1974). These people simply cannot afford to buy a selection of foods that can help keep them healthy (Smirl, 1973; Special Senate Committee on Poverty, 1974). For many other Canadians, nutritious food is financially affordable, yet there is, nevertheless, reason for concern (Nutrition Canada Survey Report, 1973).

Between 1970 and 1972, the Department of National Health and Welfare conducted an intensive nutrition survey among 20,000 Canadians. Participants came fom all ages and socioeconomic levels, as well as from urban and rural communities. Data included dietary, biochemical, anthropometric, and clinical measures that assessed the amounts of certain nutrients in the body. The results, reported in 1973 (Nutrition Canada Survey Report), were not favorable. Not only the poor had nutritional problems. A large number of children and adolescents in the general population were found to be low in calcium, vitamin D, and iron. Many pregnant women were low in protein, thiamin, and iron. A large portion of adults in the general population were low in iron and thiamin, and were plagued by overweight. There findings were especially distressing since there is reason to believe that participants were among those thought to be fairly well nourished and healthy (Nutrition Canada Survey Report, 1973; Sabry, 1975).

The Canadian report divided the sample into age groups, discussing the findings about each group separately. The two age groups of principal interest in this review of literature were the two school age groups discussed in the report, ranging from 5 to 9 years and from 10 to 19 years. Dietary information for all groups was classified into three levels designated as "inadequate", "less-than-adequate", and "adequate" amounts of certain nutrients. As can be seen in Table 2, gross deficiencies in vitamin D were found among adolescents, with 39.1% of adolescent girls having inade-

TABLE 2

DIETARY EVALUATION OF ADOLESCENTS* (10-19 YEARS OLD) PERCENTAGES WITH INADEQUATE INTAKES OF NUTRIENTS

NUTRIENT	INADEQUATE	
	Boys	Girls
Protein	1.1	3.5
Iron	17.0	40.0
Calcium	20.3	34.9
Potential Vitamin D**	26.5	39.1
Vitamin A	10.8	25.5
Vitamin C	2.8	4.7
Thiamin	2.4	10.7
Riboflavin	2.9	7.9
Niacin	0.5	2.7

* Residents in provinces exclusive of Indians in bands living on reserves and Eskimos in settlements.

** Excludes 19 year olds.

Adapted from Nutrition Canada Survey Report, 1973, Table 5-9 (p. 72) and Table 5-12 (p. 75).

quate intakes of the vitamin. "Inadequate" was designated to include intakes of nutrients that were below the desirable levels, that is, below the minimum amounts required for good health. Other serious nutrient deficiencies included iron, calcium, and vitamin A, with percentages around 25% of the adolescent population. In the group of 5 to 9 year olds (see Table 1), roughly 14% were reported as having "inadequate" intakes of iron and calcium, with approximately another 25% having "less-than-adequate" levels of these nutrients. "Less-than-adequate" was designated to include intakes of nutrients that were above the specified minimum required but still below the desired level, that is adequate for good health but with no margin of safety. As can be seen, as many as 60% or 70% of the 5 to 9 year olds were consuming less-than-desired amounts of certain nutrients, with a large number of them consuming far-less-than-desired amounts of these nutrients for good health. (Intakes designated as "adequate" were not represented on the table.) For children in the Indian and Eskimo populations, nutritional problems were even more severe.

Since the 1973 writing, Nutrition Canada has published another report entitled, Food Consumption Patterns Report (1977). This report analyzed the survey dietary information using a different statistical approach. It presented a more positive picture of the nutritional status of Canadians. In the group of 5 to 11 year olds, the mean nutrient intakes were found to be above the recommended intakes for all nutrients but free folate. For the adolescent age group, only folate and iron (females only) were below the desired recommended levels. But, as in the earlier report, Indian and Eskimo children were found to be deficient in several nutrients, most notably calcium, vitamin A, and free folate.

When comparing the two reports, one is surprised about the frequency of important nutrient deficiencies reported in 1973 (Nutrition Canada Survey Report, 1973), and the 1977 report stating that most Canadians appear to consume adequate amounts of nutritious foods. This discrepancy is partly explained by the sources of data used in the respective reports. The 1977 report was based only on the dietary information (self-reports) collected from the sample. While dietary information is one valuable source of data, other data sources had also been collected and analyzed in the original report of 1973. Clinical and/or biochemical measurements were used to identify nutritional problems including thiamin deficiency and obesity among adults, and iron deficiency among all age groups. None of these findings were presented in the Food Consumption Patterns Report of 1977. As well, this report did not identify the number of Canadians who were potential "risks" for developing complex nutrition-related diseases like coronary heart disease, hypertension, and diabetes. For these reasons, the Food Consumption Patterns Report may well reflect what people say they eat, but may be too optomistic in presenting the true nutritional status of Canadians.

SETTING NUTRITIONAL PRIORITIES

Nutrition Canada (1973) has documented problems of severe nutritional inadequacy among Canadians. Among the recommendations of the report was the need for immediate implementation of nutrition education programs for all segments of the Canadian population. "It is the right of every Canadian to be well nourished" (p. 117).

Effective nutrition education does not begin and end with a simple dissemination of knowledge. "Knowledge of itself does not have the power to make its possessors use it" (Hill, 1972, p. 2). Eating habits are socially, culturally, and emotionally bound (McGovern Report Committee, 1977; Lamb, 1969). People must see the need to change present eating habits and must want to change (Teulon, 1968).

Bricker (1963, p. 63) expresses the goals of nutrition education as helping individuals:

> (1) achieve knowledge of the body's need for nutrients
> (2) learn the role of food in furnishing nutrients
> (3) develop an enjoyable appreciation of food and a skillful use of foods both to meet the body's physical needs and to play its proper role in the individual's social and psychological needs.

While numerous nutrition education programs have been successful in transfering knowledge to recipients, they have often failed in persuading the recipients to apply this knowledge (Manoff, 1975; Whitehead, 1973). "Nutritional adequacy of foods consumed" does not appear to be a high priority concern to a large segment of the general population (Mayer, 1975; Lalonde, 1973; Manoff, 1975). Even when they have adequate knowledge of nutrition or easy access to such knowledge, some Canadians choose not to change improper eating habits.

In respect to dietary habits, nutrition is a behavioral science (Teulon, 1968; Barlow & Tillotson, 1978). To be successful, nutrition education programs must be designed to facilitate long-term behavioral change. This does not assume that all pre-nutrition education behavior is undesirable and in need of modification. It only acknowledges the fact that while knowledge of nutrition and positive attitude are important steps in the nutrition education process, behavioral changes among those with deficient diets is still the ultimate criterion by which to measure program success.

EFFECTIVENESS OF NUTRITION PROGRAMS FOR CHILDREN

The long-term goal of nutrition education for school age children as stated by the British Columbia Task Force (1973, p. 429) is "to provide students with nutrition information and the incentive to use their knowledge to improve personal eating practices". Again, while information and incentive are necessary prerequisites to behavioral change, the emphasis is on the application of this knowledge to daily eating habits. It might be expected that nutrition education programs for young children would be more effective in terms of behavioral change than programs for other age groups, simply because children's food habits are not so well established as those of adolescents or adults. This, however, is not the case. While a large number of nutrition education programs for children have reported favorable knowledge and/or attitudinal changes, many of these programs have cited only limited or no corresponding behavioral changes (Bricker, 1963; Baker, 1972; Gassie & Jones, 1972; Bell & Lamb, 1973; Head, 1974; Jenkins, Stumo, & Voichick, 1975; Allensworth & Davis, 1975; Cooper & Philip, 1974; Cosper, Hayslip, & Foree, 1977). Some programs have reported favorable behavioral changes, but these findings were based on subjective estimation as indicators of program success (Schlick, 1976; Lowenberg, 1978). Programs that have used objective evaluation methods to measure behavioral changes have not been able to identify aspects of the program that differentiated it from less successful programs. None of the programs reviewed have made provisions for follow-up studies to measure long-term benefits.

These studies indicate that nutrition education efforts have fallen short of, or perhaps more accurately, have not clearly met the long-term goal of nutrition education programs for children (Allensworth & Davis, 1975). As well, due to the difficulty of accurately measuring eating habits, these studies have provided only limited guidance for the development of more meaningful programs.

PROBLEM AREAS IN NUTRITION EDUCATION RESEARCH

Nutrition is a relatively new science, and nutrition education, a relatively new concern in the health education field. Nutrition education is ideally presented as a sequential and continuous program of food information and experience. It should begin in kindergarten and continue throughout the school years (Stewart, 1971). Presently, nutrition education is not a required course of study in the elementary curriculum. When taught, it is integrated into other course content, most frequently Health or Physical Education. Even when school boards have endorsed a program of nutrition education, it remains largely up to the individual classroom teachers to implement the program as they see fit.

Many factors have been recognized as problem areas in nutrition education and are requiring further investigation. Two of these are important in the present research and are therefore reviewed below.

The Presentation of the Program

Few elementary school teachers have had training in nutrition. Thus, they may see few possibilities for teaching it (Petersen & Kies, 1972). Those who wish to participate, may not feel well enough prepared to teach the subject (Bell & Lamb, 1973; Cooper & Philip, 1974). Others may lack the "active" interest to become genuinely involved (Petersen & Kies, 1972; Head, 1974; Roth & Wunderlich, 1976). In an attempt to help close this gap, nutrition educators have designed innovative teaching guides (Cooper & Go, 1976; Dairy Council of California, 1970), multi-media aids (Cooper & Philip, 1974), and pre-program teacher workshops (Head, 1974; Cooper & Philip, 1974; Cooper, 1977). While such provisions are both desirable and necessary, the assessibility and exposure to such nutritional knowledge and aids does not ensure that these resources will be put to appropriate or adequate use in the classrooms (Cooper & Go, 1976), especially in view of the non-compulsory nature of this type of curriculum.

The Evaluation of the Program

Nutrition education research is lacking in precise evaluative tools and methods. Specifically, school-related research is in need of accurate procedures in the following areas:

1. The measurement of both short-term and long-term behavioral changes in students needs to be developed. Although paper-pencil tests have been frequently used, such self-report instruments appear to be inaccurate in measuring behavioral changes in students (Head, 1974; Roth & Wunderlich, 1976). Better methods might include personal interviews between students and researcher, personal observations, and the commonly used plate waste studies where leftover foods from lunch room plates are recorded. Unfortunately, not all research studies lend them-

selves to such approaches in data collection (Jenkins, Stumo & Voichick, 1975).

2. The degree of teacher competence in teaching the program needs to be raised to a common level.
3. The effects of interfering variables (for example, peer pressure, family influences, program length) need to be isolated and measured.

These refinements would lead to more precise knowledge about offering effective programs in nutrition education for children.

RESOURCES USED IN TEACHING NUTRITION EDUCATION

Similar to instruction in other areas, a great variety of resource material has been employed in the nutrition education field. However, "food samples" as educational tools are probably unique. Therefore, this technique is discussed here.

The Use of "Food Samples"

Research has shown that teaching nutrition education using nutritious food samples can be an effective method of increasing the nutritional knowledge of children (Rappenthal, 1977; Whitehead, 1973). Opportunities to sample nutritious foods at school can have these benefits:

1. The "food samples" approach provides an opportunity for children to practice nutritional eating behav-

iors. Opportunity to practice desired behaviors may facilitate changes in eating habits (Skinner, 1938; Hill, 1972).

2. Using the "food samples" approach, there is no time lag between the discussion of certain foods and their importance to good health, and the opportunity to practice eating them. This may facilitate retention of nutritional knowledge and reinforce what is being taught in the classroom (Skinner, 1938).
3. The "food samples" approach provides an opportunity for children to see, feel, smell, and taste the foods under discussion. Learning experiences that allow students to taste nutritious foods provide primary reinforcement to those who participate. Such learning experiences may be more motivating to students than those activities providing only secondary reinforcement (Skinner, 1938).
4. "Food samples" activate the senses of taste and smell while standard resource materials do not. Research has shown that as more of the senses are utilized in communication, the greater the likelihood is that learning will take place (Byrd, 1971). Especially with young children, it is important for teachers to communicate in concrete ways, to offset the shortcomings of "purely verbal contact" (p. 40).
5. Using the "food samples" approach allows children to be exposed to a variety of foods that they may

not normally have in their homes, perhaps widening their range of food preference (Rappenthal, 1977).

6. Using the "food samples" approach provides an opportunity to teach young children eating manners, courtesy, sharing, and other social graces (Santee, 1971; Bettleheim, 1971; Head, 1974).
7. The use of food samples may facilitate learning because of its novelty characteristic. Unlike the more commonly used resource materials (learning games, films, puppets, posters, booklets), food samples have only limited application in the school curriculum.
8. The food samples can provide some nutritional benefit to the diets of children, especially to children who eat very poorly in the home (Panel I Report, 1970; Hill, 1972).

The "food samples" approach has had a broad range of application in the schools: food-tasting sessions (Boysen & Ahrens, 1972; Head, 1974; Shoup, 1975; Capuano, 1977), cooking classes (Santee, 1971; Rappenthal, 1977; Lowenberg, 1978), nutrition programs supplemented with specially prepared child-sized snacks, as in the ongoing Alberta "Nutrition at School" program, and nutrition education programs using the full support of existing school lunch programs (Callahan, 1971; Blakeway & Knickrehm, 1978).

The Use of Other Resource Material

Nutrition education programs for children have used a wide range of special resource material with success. The "Mulligan Stew" film series (Jenkins, Stumo & Voichick, 1975), specially designed materials for remediation workshops (films, games, science experiments) (Lowenberg, 1978), a nutrient abacus (Meyers & Jensen, 1977), the Rat-Pak animal-feeding experiments (Roth & Wunderlich, 1976), and the "Kim" child-sized paper-back booklets (Schlick, 1976) are only a few of the nutritional resources in use. As with food samples, these materials are meant to arouse student interest and encourage student activity, and thus, promote learning in an enjoyable way.

In summary, proper nutrition is seen as a fundamental prerequisite to good health. It affects all aspects of human functioning and is essential in the maintenance of biological and psychological integrity. As even moderate malnutrition can be an obstacle to learning, it is important that all school age children be properly nourished.

Based on evidence that many Canadians have nutritionally deficient diets (Nutrition Canada Survey Report, 1973), nutrition education programs have been developed to help Canadians improve poor eating practices. In general, these programs have met with limited success. Eating habits appear to be self-chosen behaviors that can be very difficult to change. While nutritional knowledge and favorable attitudes are seen as necessary prerequisites to positive change in dietary behavior, these changes are not seen as the ultimate program goals. Rather, changes in knowledge and attitudes are only useful if followed by wise food selections.

School teachers can play a significant role in the food habit formation of children and the success of nutrition education programs in the schools. Resource material has been developed to help teachers present nutrition education programs with increased effectiveness. "Food samples" may facilitate nutritional learning in ways that standard resources cannot.

As evaluation is an important consideration in the development of more meaningful programs, it will be necessary to refine the present tools and techniques of nutrition education research.

CHAPTER III

THE DESIGN AND PROCEDURES

The need for nutrition education was demonstrated in Chapter I. Several different methods of providing such a nutrition education program were reviewed in Chapter II. In this chapter, the design and data collection procedures for evaluating the 1975-76 Alberta nutrition education program are discussed. This particular program of nutrition education is an ongoing program funded by the Department of Agriculture of the province of Alberta.

During 1975, the department awarded a contract for the evaluation of the program to Dr. A. L. Harvey, Faculty of Education, University of Alberta. As a part of this evaluation, three different methods of teaching the nutrition program were compared with a view toward determining their relative effectiveness. A report completing this evaluation contract was submitted to the department during May, 1976. The writer worked in this study as a research assistant to Dr. Harvey, and participated in the detailed work required in designing and pilot testing of the instruments (see Appendices A and B), as well as the data collection.

The wealth of data which was collected for this evaluation justified a more detailed analysis than was specified in the evaluation contract. Therefore, the writer sought and obtained permission to re-use this data for the purpose of this thesis.

THE RESEARCH DESIGN

The Alberta nutrition education program uses curriculum materials published as the "Big Ideas in Nutrition Education" (Ontario Milk Marketing Board, undated). Separate packages are specifically designed for grades 1 to 3, and for grades 4 to 6. Each package provides a step-by-step instructional procedure for teaching nutrition as well as nutrition information and suggested learning activities. Teachers for these grades are asked to include the program (on a volunteer basis) whenever they find it appropriate during the school year. All teachers whose students are exposed to the program are to attend one-day workshops delivered by district home economists before commencement of the program.

To allow for evaluative comparisons, the nutrition education program was offered in three different forms to schools during 1975-76. While all three forms attracted some participating schools for the evaluation, only the two most frequently used forms (Nutrition Education Plus Food Samples, and Intensively Resourced Nutrition Education) yielded an adequate number of returns for comparisons.

To test the relative effectiveness of the programs, a design involving pretest, treatment, posttest was employed. Each grade level from grade 1 to 6 was tested separately. Pretests were generally administered during early January, 1976, and posttests during April, 1976, with the various nutrition education programs taking place between these events at the teachers' discretion.

THE POPULATION AND SAMPLE

Students at each grade level from 1 to 6 can be viewed as a separate population, yielding six distinct populations for this research. A two-stage sampling procedure was employed. At the first stage, schools were randomly selected from the lists of those offering one of the treatments, and from others offering no exposure to the program (Control Group). In the case of the control group, superintendents were asked to identify a school of comparable size and socio-economic status to the school drawn into the treatment sample from that district. The first six grades at each of the identified schools then formed the first-stage sampling units. Only those grades that returned both the pre- and posttest questionnaires were retained in the final sample.

Students within those grades formed the second-stage sampling units. To equalize the effects of extraneous factors such as differences in teachers or classroom environments, it was decided to equalize the weight of each first-stage sampling unit by randomly drawing an equal number of students from each class, even though all students generally participated in both the pre- and posttests. In view of the number of first-stage sampling units (see

Table 3 for a list of the selected schools), it was decided that 10 students from each class would yield a large enough sample of students (50 or greater) for analysis. Therefore, ten questionnaires were randomly selected from all those returned for the pre- and posttests from the same class. Thus, while the 10 students for pretest analysis were randomly drawn from the same class as the 10 for posttest analysis, the two samples are independent sub-samples of the same first-stage sampling unit.

No attempt was made to identify the questionnaires by student names. This was mostly a result of the limited ability of students in the very early grades to write their names legibly. Therefore, matching of pre- and posttest questionnaires was precluded.

THE TEACHING METHODS INVESTIGATED

The original contract specified that three different teaching methods be compared:

(A) teaching the "Big Ideas" education program by allowing children to taste the foods under discussion (Nutrition Education Plus Food Samples)

(B) teaching the "Big Ideas" education program with ample support of specially prepared audio-visual materials (Intensively Resourced Nutrition Education)

TABLE 3

SCHOOLS SELECTED FOR EVALUATION

SCHOOL NAME	ADDRESS	RETURNS BY GRADE 1	2	3	4	5	6
(A) Food and Nutrition							
Ross Ford	Didsbury	*	*	*	*	*	*
Champion	Champion	*	*	*	*	*	*
Queen's Park	Calgary	*	*	*	*	*	*
McDougall	Calgary		*	*	*	*	*
St. Gerard	Edmonton	*	*		*		*
Savanna	Silver Valley			*	*	*	*
(B) Intensively Resourced Nutrition							
Provost	Provost	*	*	*	*	*	
Mundare	Mundare	*	*	*	*	*	*
Tofield	Tofield	*		*	*		*
E. H. Walter	Paradise Valley	*	*	*	*	*	*
(c) Control							
Hazel Cameron	Vulcan	*	*	*	*	*	*
Olds	Olds	*			*	*	*
King George	Calgary			*		*	*
St. Andrew	Edmonton	*	*	*	*	*	*
Bonanza	Bonanza			*	*	*	*

(c) teaching the "Big Ideas" education program without food samples or use of specially prepared materials (Nutrition Education Only).

Due to very low returns of classroom data that can be classified as Category C (teaching the program without support of food samples or additional teaching resources), this category was excluded from further analysis. It seems that nutrition is rarely taught in schools without any kind of support materials, therefore, enough data to evaluate Method C could not be obtained. As a consequence, only the teaching method supplemented with additional teaching resources (Method B) and the method providing food samples (Method A) were analyzed here.

THE INSTRUMENTS

The original evaluation contract was set up to assess the effectiveness of the Alberta "Nutrition at School Program" in terms of (1) changed behavior (2) changed attitude and (3) increased knowledge of students. Data relating to the attitudes of parents, teachers and school administrators were also collected and analyzed in the original study.

Separate instruments were developed for each of these purposes, and were used during the evaluation. Since the writer's interest is in the cognitive effect of the different teaching methods used, only that part of the data measuring students' knowledge of appropriate nutrition behavior was examined in this study.

Development of Instruments

Six different instruments were developed for measuring students knowledge of nutrition, one for each grade level from 1 to 6. Knowledge items for each grade were based directly on the program objectives as outlined in the "Big Ideas" packages. These objectives were categorized according to Bloom's Taxonomy of Educational Objectives, Cognitive Domain (1956). The three levels of the taxonomy in order of increased complexity or depth of understanding are (1) Knowledge (2) Comprehension and (3) Application. Bloom (1956) claims that before learning can take place at an advanced level, it must go through the preceding stages in the indicated order. The taxonomy was used as a guide in developing test items that could help determine whether student learning was taking place at the level each objective was to be taught. Accordingly, the objectives for the program were categorized as follows:

Grades 1, 2 and 3

1. The student will be able to name a variety of foods. (Knowledge)
2. The student will be able to classify food into one of four correct food groups. (Knowledge)
3. Given an assortment of foods, the student can apply his knowledge of the Four Food Groups by selecting a well-balanced meal. (Comprehension)
4. The student will demonstrate an understanding of the importance of food to growth and health. (Comprehension)

Grades 4, 5 and 6

1. The student will discover by experiment that different foods contain different nutrients. (Knowledge)
2. The student will classify food into the Four Food Groups on the basis of nutrient content. (Knowledge)
3. The student will explain the role of nutrients in food for his growth, health and energy needs. (Comprehension)
4. The student will apply his knowledge of the Four

Food Groups in choosing a varied and balanced selection of food to meet his daily needs. (Application)

Multiple choice and short answer knowledge items for each of the six grades were developed using the categories of Bloom"s Taxonomy as the basis for their construction. A pool of possible items was obtained by posing the problem to a class of undergraduate students. The students were asked to categorize the items according to the levels of Bloom's Taxonomy. Only high-level agreement items were kept as possible items for the First-Stage Questionnaires. First-Stage Questionnaires were assembled by Dr. Harvey and the writer and given to an Elementary Curriculum Specialist for examination. The Curriculum Specialist agreed to examine the test items in terms of (1) reading level (2) clarity and (3) classification according to the Cognitive Domain as outlined earlier. The Curriculum Specialist was to determine whether test items at each grade level were suitable in terms of the cognitive levels of the children. The Curriculum Specialist made suggestions for improvement and appropriate changes were made. Changes included clarification of questions, picture additions, and refinement of some of the questions testing domain classifications. These Second-stage Questionnaires were submitted to two Foods and Nutrition Specialists who originated the "Nutrition at School Program" in Alberta. These specialists examined the test items in terms of (1) wording (whether it was nutritionally acceptable or not) and (2) correct response range. Again, additional changes were made to the questionnaires following the suggestions of these specialists.

Pilot Testing

Some Alberta elementary schools commenced the "Nutrition at School" program in the Fall, 1975. This was earlier than most. Due to this, these schools could not be included in the research. Five of these schools were asked to cooperate in trial completion of the questionnaires in November, 1975. Permission was received from the appropriate superintendent in rural areas or the research officer for the school board in urban areas and the school principal in each case. The schools participating in the pilot test were:

Urban Schools	
Mill Creek School	Edmonton
St. Basil Separate School	Edmonton
King Edward Elementary School	Calgary
Rural Schools	
H. A. Kostash School	Smoky Lake
Consort School	Consort

The pilot questionnaires were first administered to students at Mill Creek School in Edmonton. The writer observed the testing and collected comments from students and teachers. After the trial run, a few changes were made in some of the questionnaires. These revised pilot questionnaires were then administered to the remaining four schools. At least one class of students at each grade level was tested in each school.

The completed questionnaires were collected and the responses were coded. Upon examination it was decided to discard or alter the wording of some of the cognitive items that did not elicit a range of responses, in an attempt to improve the sensitivity of the items. Care was taken to consult the specialists again about all modified items before the questionnaires were printed in final form as shown in Appendix A. These became the pretest questionnaires. A parallel form was then constructed for the posttest by substituting answer choices or comparable items for cogitive items on the pretest questionnaire. These posttest questionnaires are shown in Appendix B.

COLLECTION OF DATA

Selection of Sample

The Alberta "Nutrition at School" program is offered province-wide in both rural and urban communities. Not all participating schools were eligible for inclusion in the present evaluation. Schools had to meet the following criteria to be eligible for sampling:

1. A Nutrition Education program was available either as: (A) Nutrition Education Plus Food Samples, or
   (B) Intensively Resourced Nutrition Education.

2. The program only began in January, 1976.
3. The program was new for the school.
4. The school did not offer a school lunch program.

At the time of sample selection, 28 schools giving treatment A (Nutrition Education Plus Food Samples) had been identified. From these, six were randomly selected to participate in the evaluation. Similarly, 11 schools giving treatment B (Intensively Resourced Nutrition Education) were identified. From these, five were randomly selected. One of the schools in Group B withdrew their participation in the evaluation, leaving four schools in this group. For each selected school, a comparable school not offering the program was identified. From this pool, five schools were selected for control purposes. Table 3 shows the names of all selected schools.

Administering of Questionnaires

Pretest packages including cover letter, student questionnaires, and return envelope were mailed directly to the teachers of participating schools in early January. The teachers were asked to return completed pretest questionnaires as soon as possible. As return envelopes were received by the researcher, ten questionnaires were randomly drawn from each envelope. For two classes, fewer than ten questionnaires were returned. In each case, all were included in the evaluation. Questionnaires were numbered for future reference. Pretest data were coded as outlined below under "Coding and Weighting of Raw Scores", keypunched, and stored in the computer.

Collection of posttest data was done in similar fashion as the data collection for the pretest. The student questionnaires were mailed to the teachers at the end of March. Again, ten student questionnaires were randomly pulled from each returned envelope and given identification numbers. Responses were coded, keypunched, and stored in the computer. Only those classes from the selected schools that responded to both pre- and posttest were included in the data analysis. These are identified with asterisks (*) in Table 3.

Several efforts were made to collect all the missing returns, but due to contractual deadlines, data collection was terminated at the end of April, 1975. Even though a few teachers did not return both pre- and posttests for their classes, there were no systematic omissions of data. A sufficient number of cases for all three groups A, B, and C was available for analyzing each grade from one to six.

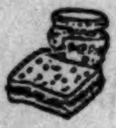
Coding and Weighting of Raw Scores

Pre- and posttest questionnaires for all grades were parallel forms of the same instrument. The scoring for each grade was identical for both pre- and posttest.

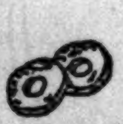
An example of a cognitive item for students in grades 1 to 3 is displayed in Figure 1. This question asked the students to choose three foods for a lunch which is "good for you". The maximum score for this question was 4 points. It was possible to get these by choosing from the food items

SAMPLE COGNITIVE ITEM (GRADES 1 TO 3)

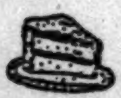
4. Draw an X on 3 foods that make a lunch that is good for you.



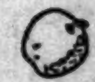
peanut butter sandwich



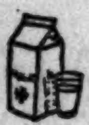
doughnut



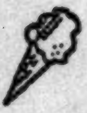
cake



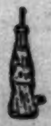
apple



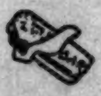
milk



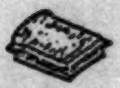
ice cream



pop



chocolate bar



meat sandwich

FIGURE 1

shown in the figure, any combination of foods representing a balanced selection of one food from each of the four food groups. Examples would be:

(1) peanut butter sandwich and apple and milk (or ice cream)

(2) meat sandwich and apple and milk (or ice cream).

For any food group not selected, the total possible score was reduced by 1 point. Penalty points were given if one or more nutritionally poor foods (doughnut, cake, pop, chocolate bar) were selected in combination with an excess number of food selections, to a maximum of 2 penalty points, 1 point off for each poor choice made.

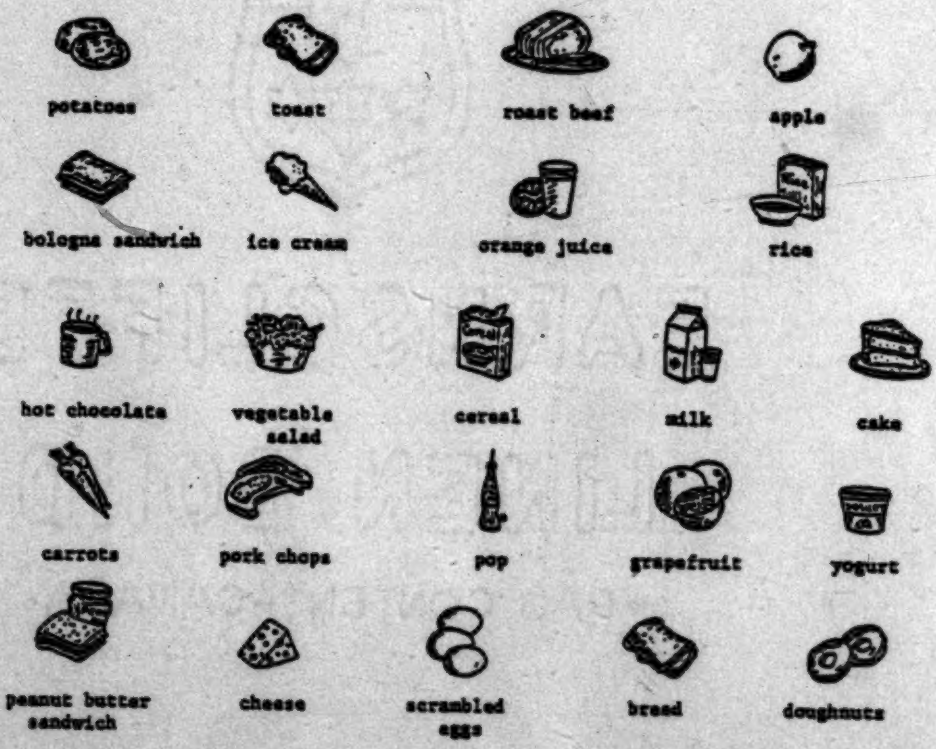
The parallel posttest item for this question provided a different list of food choices, with "hot dog" and "jam sandwich" being substituted for the "doughnut" and "meat sandwich" choices on the pretest question.

A comparable item for students in grades 4 to 6 (Figure 2) directed students to choose the foods that would meet their nutritional needs for one day, not just for one meal. The basic format for scoring this question was similar to that of the grade 1 to 3 test item. In this case, penalty points could be accumulated in accordance with a scheme which utilized the greater expected nutritional understanding of students in these higher grades.

The pretest knowledge items for each grade were scored according to the scheme presented in Table 4.

SAMPLE COGNITIVE ITEM (GRADES 4 TO 6)

10. Suppose you are choosing the food for one day to meet your daily needs. Choose from the list below. You may choose the same food more than once. You may leave out some of the foods.


potatoes
toast
roast beef
apple
bologna sandwich
ice cream
orange juice
rice
hot chocolate
vegetable salad
cereal
milk
cake
carrots
pork chops
pop
grapefruit
yogurt
peanut butter sandwich
cheese
scrambled eggs
bread
doughnuts

Write the foods you select on the lines below - one food per line.

Breakfast	**Lunch**	**Dinner**	**Snacks**

FIGURE 2

TABLE 4

CODING SCHEME FOR COGNITIVE ITEMS ON PRETEST* QUESTIONNAIRES

GRADE	QUESTION NUMBER	POINT VALUE FOR QUESTION	MAXIMUM RAW SCORE
1	3	2	12
	4	4	
	5	2	
	6	4	
2	4	1	14
	5	3	
	6	4	
	7	2	
	8	4	
3	4	2	14
	5	1	
	6	4	
	8	4	
	9	3	
4	4	1	17
	6	1	
	7	1	
	9	2	
	10	12	
5	3	1	17
	4	1	
	5	1	
	9	2	
	10	12	
6	5	1	17
	6	1	
	10	1	
	11	2	
	12	12	

* The parallel posttest items were scored in the same fashion.

STATEMENT OF HYPOTHESES

As detailed in Chapter I, the two hypotheses tested were as follows:

Research Hypothesis I

H_1: The method of teaching nutrition by providing food samples is superior (in terms of knowing appropriate dietary behavior) to the method providing intensively resourced instruction without food samples.

H_1 will be accepted if the probability of the null-hypothesis is less than 0.05.

Research Hypothesis II

H_1: The method of teaching nutrition by providing intensively resourced instruction is superior (in terms of knowing appropriate dietary behavior) to no instruction (control group).

H_1 will be accepted if the probability of the null-hypothesis is less than 0.05.

In summary, the present evaluation was intended to determine the relative effectiveness of two different methods of teaching nutrition education in increasing the cognitive scores of elementary school children, grades 1 to 6. The treatments (A) Nutrition Education Plus Food Samples and (B) Intensively Resourced Nutrition Education were offered in Alberta schools as part of the 1975-76 "Nutrition at School" program. Ten schools were randomly selected to receive either treatment A or B; five other schools were selected as controls (C). Student instruments were based on program objectives and were categorized according to Bloom's taxonomy. Separate instruments were developed for each grade level, pilot tested, and finalized during the Fall, 1975. Data from selected schools were collected between January and April. A pretest, treatment, posttest design was employed, and only those grades from the participating schools that returned both pre- and posttest questionnaires were retained for the analysis. For each grade, ten student questionnaires were randomly drawn from both pre- and posttest returns. These were then coded, keypunched, and stored in the computer.

CHAPTER IV

ANALYSIS OF DATA AND RESULTS

The anonymity of pre- and posttest questionnaires precluded a matching of returns, and this also precluded the use of covariance methods for analyzing the data. The independent drawing of 10 pretest and 10 posttest questionnaires from the returns of each class fulfills one of the assumptions of Analysis of Variance. It was therefore used to estimate the significance of differences.

One problem arising in two-stage sampling procedures such as the one employed here is error variation which can be attributed to the first stage, that is, the schools. Each school is unique in providing a learning environment composed of different classrooms and teachers, and possibly other factors. When estimating the effectiveness of a teaching method in a laboratory, all these factors can be controlled. In the real world, it would be difficult to control them. Further, such control could in itself be a factor impinging on the outcome.

Extraneous variation arising from factors irrelevant to the experiment can sometimes be minimized by adjusting the data. Suppose, for instance, that two classes of Grade 1 students (X and Y) participated in the same pretest. On the pretest, class X scored an average of 10 points, while class Y's average was only 7 points. The difference is attributable to factors extraneous to the experiment because the difference is already present before the experiment began. If not adjusted, it increases the error term in the analysis of variance, and this reduces the significance of results. This difference can be controlled by adding 3 points to the pretest and posttest scores of each student in class Y, thus equating the two classes on the basis of their pretest scores.

Another method of equating scores to diminish extraneous variance attributable to first-stage sampling might be to standardize pre- and posttest scores for each class. However, standardization adjusts both the mean and the variance of the differences. In the present instance, the variance needs to be retained to permit better comparisons of absolute effectiveness among teaching methods. Therefore, it was decided to minimize extraneous variance only by centering each class around a common mean by adding an appropriate constant to both pre- and posttest raw scores such that all class-means of a given grade would be equal on the pretest (see Glass & Stanley, 1970). The grand-mean of all pretest classes of a given grade was used to calculate the appropriate constant for each class mean of that grade.

In summary, scores were calculated and transformed as follows:

1. Calculate raw scores for each student using the scoring procedure and weights discussed under the heading "Coding and Weighting of Raw Scores".
2. For pretest scores only, calculate the mean for

each class, as well as the grand-mean for each grade.

3. Add the difference between the pretest grand-mean and the class mean to both pre- and posttest scores. to equalize existing pretest differences.

The above transformation is linear. The effect of the transformation is to reduce the first-stage sampling variation attributable to factors extraneous to the hypotheses tested, perhaps enhancing the statistical significance of the analysis. The scores so obtained were then examined by using Analysis of Variance.

Since all participating classes of the same grade were equalized on the basis of pretest scores, they all began at the same starting point, so to speak. Therefore, only the differences at the end of the treatment period needed to be examined. A one-way analysis of variance was used to analyze the significance of posttest differences among the three groups: (A) Nutrition Education with Food Samples, (B) Intensively Resourced Nutrition Education, and (C) Control Group.

Grade 1 Results

Table 5 shows the Raw Score Means of the knowledge scores for Grade 1 for both pre- and posttests. It also shows the Equalized Score Means which resulted from adjusting each student's score according to the deviation of his/her class mean from the grand mean. These knowledge score means are given for all three groups, A, B, and C.

The analysis of variance of the Equalized Posttest

TABLE 5

NUTRITION KNOWLEDGE OF GRADE 1 STUDENTS

GROUP	N	RAW SCORE MEANS		EQUALIZED SCORE MEANS	
		Pre-test	Post-test	Pre-test	Post-test
(A) Food and Nutrition	40	8.9	9.7	8.9	9.7
(B) Resourced Nutrition	40	8.8	9.2	8.9	9.3
(C) Control	40	9.0	9.2	8.9	9.1

TABLE 6

ANALYSIS OF VARIANCE FOR EQUALIZED POSTTEST SCORES OF GRADE 1 STUDENTS

SOURCE OF VARIATION	DF	MEAN SQUARE	F	PROBABILITY
Three Groups	2	3.36	1.47	0.235
Error	117	2.29		

Scores is shown in Table 6. As can be seen, the differences between these means has a probability of p = 0.235 of occuring by chance, and therefore is not statistically significant.

Grade 2 Results

Table 7 shows the Raw Score Means as well as the Equalized Score Means for Grade 2. The analysis of variance of the Equalized Scores (Table 8) shows that the probability of obtaining similar differences by chance is less than 0.001. One can, therefore, assume that the difference among the means is due to the treatment. As can be seen, the means are ordered in the hypothesized sequence, with group A having the highest mean, group C having the lowest mean, and group B's mean being between these two.

Grade 3 Results

Table 9 shows the Raw Score and Equalized Score Means for Grade 3, with the analysis of variance of the three groups being shown in Table 10. Again, the probability of obtaining these differences by chance is less than 0.001. However, it is noteworthy that while group A scored highest, as expected, group B scored lower on the posttest than it did on the pretest. The Standard Error for group B's mean is approximately 0.25 on the pretest mean, and 0.26 (nearly identical) on the posttest mean (see Appendix C

TABLE 7

NUTRITION KNOWLEDGE OF GRADE 2 STUDENTS

GROUP	N	RAW SCORE MEANS		EQUALIZED SCORE MEANS	
		Pre-test	Post-test	Pre-test	Post-test
(A) Food and Nutrition	60	9.7	10.7	9.9	10.9
(B) Resourced Nutrition	30	9.6	9.9	9.9	10.2
(C) Control	20	10.7	9.3	9.9	8.5

TABLE 8

ANALYSIS OF VARIANCE FOR EQUALIZED POSTTEST SCORES OF GRADE 2 STUDENTS

SOURCE OF VARIATION	DF	MEAN SQUARE	F	PROBABILITY
Three Groups	2	43.85	13.67	0.000***
Error	107	3.21		

*** Significant at p less than 0.001

TABLE 9

NUTRITION KNOWLEDGE OF GRADE 3 STUDENTS

GROUP	N	RAW SCORE MEANS		EQUALIZED SCORE MEANS	
		Pre-test	Post-test	Pre-test	Post-test
(A) Food and Nutrition	50	9.9	10.4	10.0	10.5
(B) Resourced Nutrition	35	10.5	9.4	10.0	8.9
(C) Control	38	9.6	9.3	10.0	9.7

TABLE 10

ANALYSIS OF VARIANCE FOR EQUALIZED POSTTEST SCORES OF GRADE 3 STUDENTS

SOURCE OF VARIATION	DF	MEAN SQUARE	F	PROBABILITY
Three Groups	2	23.94	9.52	0.000***
Error	120	2.51		

*** Significant at p less than 0.001

for a table of all group means and standard deviations). Therefore, the pre- and posttest means for group B differ by about 4 standard errors - an event which is improbable to occur by chance.

Grade 4 Results

Table 11 shows both the Raw Score and Equalized Score means for Grade 4, while Table 12 presents the analysis of variance for the Equalized Scores. It can be seen that the probability of obtaining the indicated differences by chance is less than 0.001. One can, therefore, assume that the difference is due to the treatment. The groups are ordered in the hypothesized sequence, with group A scoring highest, group C scoring lowest, and group B scoring between these two.

Grade 5 Results

Table 13 shows the group means for both Raw Scores and Equalized Scores for Grade 5. The trend of earlier results appears to be maintained with group A scoring highest, but as indicated in Table 14, the probability of these differences occuring by chance is 0.134. Since this is larger than the commonly accepted 0.05 level, no conclusion can be drawn from the Grade 5 results.

TABLE 11

NUTRITION KNOWLEDGE OF GRADE 4 STUDENTS

GROUP	N	RAW SCORE MEANS		EQUALIZED SCORE MEANS	
		Pre-test	Post-test	Pre-test	Post-test
(A) Food and Nutrition	60	12.1	12.6	12.1	12.7
(B) Resourced Nutrition	40	12.2	11.5	12.1	11.4
(C) Control	34	12.4	10.8	12.1	10.5

TABLE 12

ANALYSIS OF VARIANCE FOR EQUALIZED POSTTEST SCORES OF GRADE 4 STUDENTS

SOURCE OF VARIATION	DF	MEAN SQUARE	F	PROBABILITY
Three Groups	2	51.17	14.96	0.000***
Error	130	3.42		

*** Significant at p less than 0.001

TABLE 13

NUTRITION KNOWLEDGE OF GRADE 5 STUDENTS

GROUP	N	RAW SCORE MEANS		EQUALIZED SCORE MEANS	
		Pre-test	Post-test	Pre-test	Post-test
(A) Food and Nutrition	50	11.3	12.0	11.4	12.1
(B) Resourced Nutrition	30	11.6	11.5	11.4	11.3
(C) Control	50	11.5	11.6	11.4	11.5

TABLE 14

ANALYSIS OF VARIANCE FOR EQUALIZED POSTTEST SCORES OF GRADE 5 STUDENTS

SOURCE OF VARIATION	DF	MEAN SQUARE	F	PROBABILITY
Three Groups	2	7.24	2.04	0.134
Error	127	3.54		

Grade 6 Results

Table 15 shows the Raw Score and Equalized Score Means for Grade 6. The probability of obtaining such differences is 0.014, as shown in Table 16. This probability is below the 0.05 level, and therefore, it can be concluded that the groups are not similar with regard to nutrition knowledge at posttest time. While group A scored highest again, the sequence for groups B and C, is not as expected. Group B scored lowest, showing an insignificant gain in knowledge, while the control group (C) scored between groups A and B.

SUMMARY OF RESULTS

All results for the six grades are graphically summarized in Figures 3 to 8. These figures use the Equalized Score Means of each grade level to show the three groups departing at the same starting point. The posttest means demonstrate the relative gains and losses with reference to this starting point.

As can be observed, group A (Nutrition Education Plus Food Samples) showed a gain for all six grades. In four grades (grades 2, 3, 4, and 6), this gain was statistically significant. Therefore, Hypothesis I, namely, treatment A is superior to treatment B, can be accepted with confidence.

On the other hand, Hypothesis II (treatment B is superior to no treatment) remains in doubt. As can be observed, group B performed better than group C in only three of the

TABLE 15

NUTRITION KNOWLEDGE OF GRADE 6 STUDENTS

GROUP	N	RAW SCORE MEANS		EQUALIZED SCORE MEANS	
		Pre-test	Post-test	Pre-test	Post-test
(A) Food and Nutrition	60	11.3	13.1	11.4	13.2
(B) Resourced Nutrition	30	11.6	11.8	11.4	11.6
(C) Control	50	11.4	12.6	11.4	12.5

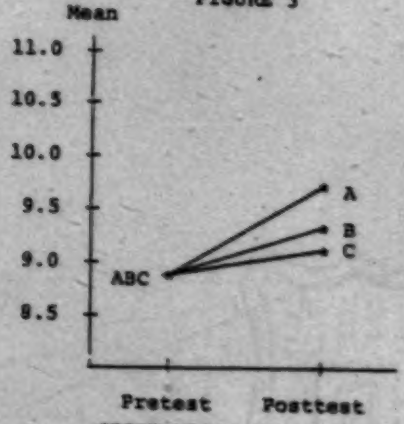
TABLE 16

ANALYSIS OF VARIANCE FOR EQUALIZED POSTTEST SCORES OF GRADE 6 STUDENTS

SOURCE OF VARIATION	DF	MEAN SQUARE	F	PROBABILITY
Three Groups	2	25.86	4.44	0.014**
Error	137	5.83		

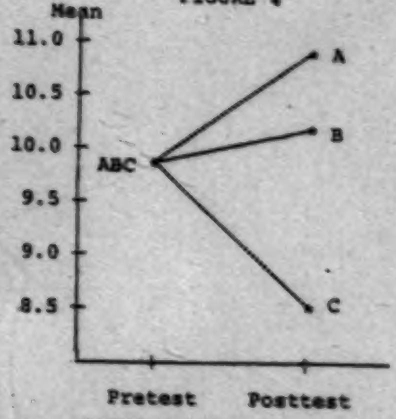
** Significant at p less than 0.05

FIGURE 3



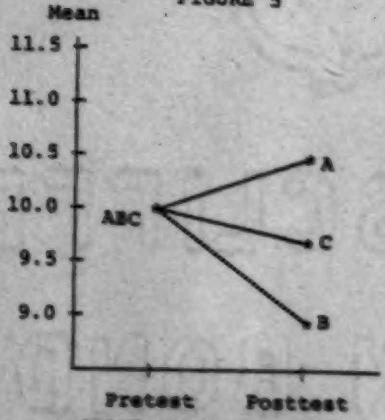
GROUP MEANS FOR GRADE 1

FIGURE 4



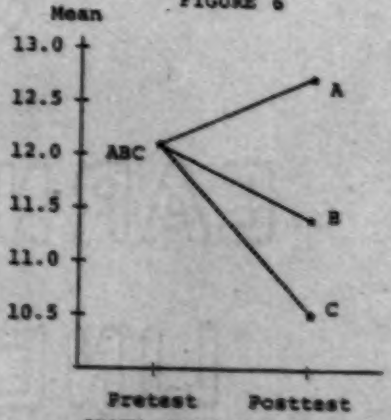
GROUP MEANS FOR GRADE 2

FIGURE 5



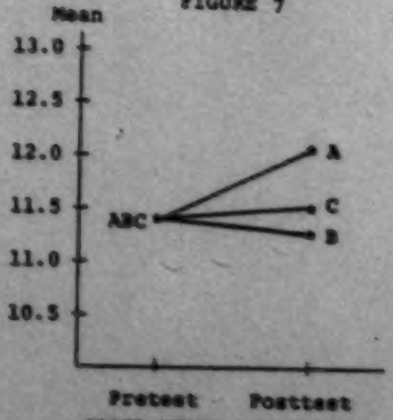
GROUP MEANS FOR GRADE 3

FIGURE 6



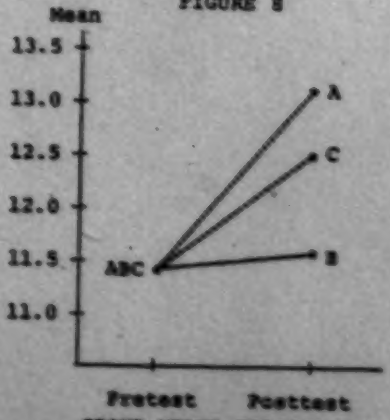
GROUP MEANS FOR GRADE 4

FIGURE 7



GROUP MEANS FOR GRADE 5

FIGURE 8



GROUP MEANS FOR GRADE 6

six grades (grades 1, 2, and 4) while in grades 3, 5, and 6, it lost ground relative to group C. Most of the pre- and posttest differences for groups B and C are within usual variation for independent samples, except in the case of grade 3, where group B showed a less appropriate knowledge of nutrition at posttest time than at pretest time (Figure 5). The writer has no knowledge of any factors causing this surprising result.

In summary, Hypothesis I was accepted, and the data does not warrant a firm conclusion with regard to Hypothesis II.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

In this study, the increase in knowledge about appropriate nutritious foods was examined in three groups of students across grades 1 to 6. Group A received nutrition education supported by tasting food samples of the food items under discussion, group B received nutrition education supported by ample multi-media resources, and group C received no nutritional instruction (control group). Results indicated that nutrition knowledge increased in all six grades when using treatment A (see Figures 3 to 8). However, treatment B was not significantly different from no treatment (control group). Therefore, Hypothesis I "Nutrition instruction supported by tasting of food samples is superior to intensively resourced nutrition instruction" was accepted, while Hypothesis II "Intensively resourced nutrition instruction is superior to no nutrition education" was rejected.

While the results concerning group B are disappointing, some differences that may have affected the administration of treatment A and treatment B should be mentioned. Treatment A involved the preparation of the food samples which were to be tasted. Generally, these food samples were prepared by a parent or other community member who was paid for this service. While this relieved the teacher from full responsibility to provide resources for a lesson, it also increased the teacher's obligation to "follow through" with implementing the nutrition lesson, as the snacks would arrive at a prescribed time. In effect, this feature assured that the program would be presented consistently and systematically. The teacher had no choice but to become involved. Treatment B consisted mainly of regular classroom instruction using the procedures and suggested activities outlined in the "Big Ideas" packages, as well as additional materials and films available from the Alberta Department of Agriculture. In this treatment, presentation and choice of aids were left entirely up to the discretion of each teacher. It may well be that group B received a much less systematic treatment than group A simply because teachers knew that they were under no obligation to teach the program. This notion is supported by data collected from the teachers which indicated that not all teachers made the effort to order the films and materials which could have made their lessons more effective. Because nutrition education is not part of the prescribed curriculum, it may have been treated as a low priority item, even though teachers volunteered to offer it.

There may have been a difference in the ease with which each program could be implemented. It is generally recognized that resource materials can increase the effectiveness of instruction in any curriculum area. Good resources tend to be novel, easy to prepare and present, motivating to students, and enjoyable to both student and teacher. Snack foods as resources can provide for each of these requirements, while other resources may not. Snacks are simple tools with flexibility and a broad range of application. Since eating is a source of pleasure, by varying the foods used, snacks can be made interesting and satisfying to the majority of students at any given time. If a class of students is particularly adventurous, snacks can be chosen to satisfy their curiosity. If a class is more reserved, more conservative foods can be found. The teacher is in a position to select a varity of foods that will help draw out favorable behavioral responses in different groups of students. On the other hand, the physical properties of films, games, books, and models cannot be manipulated to the same extent. Once used, many of these lose their interest or novelty effect. Thus, the need to find stimulating resources was probably a greater concern for teachers in treatment B. Teachers in this treatment group may not have had the time or inclination to seek out presentation alternatives. Some of them may have hesitated to use even the resources available from the Department of Agriculture simply because these resources were unfamiliar, and required previewing or screening before being used with confidence. This notion is supported by the data which indicated that teachers did not use the Department of Agriculture materials extensively. In all fairness, treatment B is likely a program that is more difficult to implement, at least the first time it is taught.

Not only did the type of treatment likely influence the extent and ease with which teachers could become involved in the program, it likely influenced the involvement of students. Students in group A had the opportunity to taste nutritious food samples immediately after the discussion of these foods in class. They all were actively involved. Not all learning activities can involve a whole group of students and be enjoyed so easily. Some learning activities are competitive in nature or limit the number of students who can actively participate at one time. Some can require a great deal of student effort before they can be enjoyed and learned from. At times, activities can be threatening to some students, or can create a feeling of self-consiousness or inferiority. Then, some learning experiences require no active participation at all. The pleasure received from food tasting sessions would be hard to duplicate using a more standard media approach in a regular lesson. In this study, using food snacks may have had a novelty effect or created an atmosphere of importance for the nutrition program because these experiences were very different from any other course content offered by the school. For these reasons, nutrition information presented in combination with the opportunity to sample nutritious snacks may have facilitated the retention of nutritional knowledge.

For the future, treatment A (Nutrition Education Plus Food Samples) can be recommended as an effective method of increasing nutritional knowledge of young children in schools. Regarding the effectiveness of treatment B (Intensively Resourced Nutrition Education), several facilitating circumstances should be present when repeating the evaluation of this treatment:

1. A means of assuring the systematic administration of the treatment should be found. Perhaps the teaching of nutrition should be part of the curriculum so that teachers need not offer it on a voluntary basis.
2. Teachers should have easy access to resource material. Supportive audio-visual packages could be placed in school libraries so that they are more easily assessible. This would eliminate the need to have to order or wait for these materials.
3. A more intensive Teacher Workshop should be given before program commencement to (a) provide more nutrition background information (b) stimulate teacher interest and (c) familiarize teachers with the scope of the "Big Ideas" packages and other available resource materials.

It is felt that these three areas of improvement should show improved results for treatment B.

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APPENDIX A

PRETEST QUESTIONNAIRES

GRADE 1 QUESTIONNAIRE

Items used for the knowledge score:

ITEM NUMBER	BLOOM'S CATEGORY	POINT VALUE	MAXIMUM SCORE
3	Knowledge	2	12
4	Comprehension	4	
5	Comprehension	2	
6	Comprehension	4	

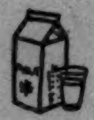
Name ______________________________
(First) (Last)

GRADE I

The teacher is requested to read each question to the students. Please give help interpreting pictures only where there are labels.

Ask students to stop when they come to each line until given directions to go on to the next question.

1. Draw an X on the foods you like to eat.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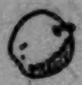
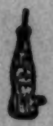
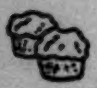
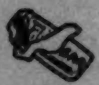
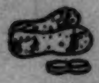
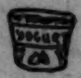

apple


pop


bran muffin


chocolate bar


nuts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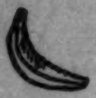
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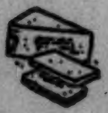
cheese

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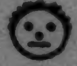
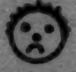
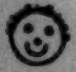
2. Draw an X on the face that shows how you feel when you are learning about food.







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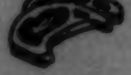
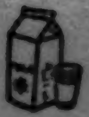
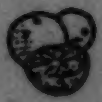
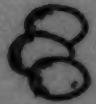
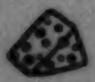
3. Draw an X on all the foods that have milk in them.



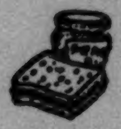




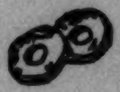




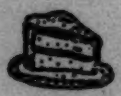
4. Draw an X on 3 foods that make a lunch that is good for you.



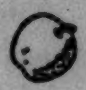
peanut butter sandwich



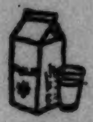
doughnut



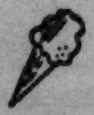
cake



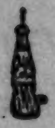
apple



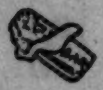
milk



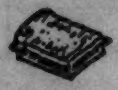
ice cream



pop



chocolate bar



meat sandwich

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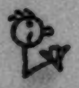
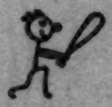
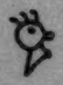
5. Draw an X on all the children who are doing something that makes them healthy.



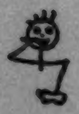
eating a banana



playing baseball

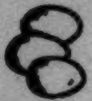


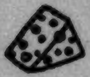
chewing a pencil

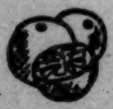


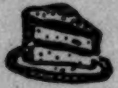
brushing teeth

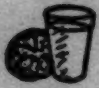
6. Draw an X on 4 foods that make a breakfast that is good for you.


eggs


cheese


grapefruit


cake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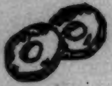
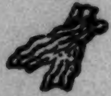
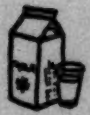
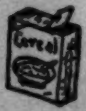
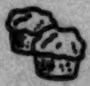

doughnuts

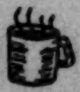

bacon


milk



cereal


bran muffin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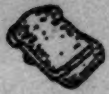
toast

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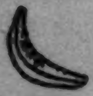
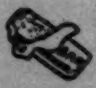
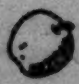
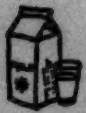
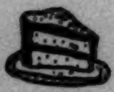
7. Draw an X on the snacks you eat after school.


banana


chocolate bar


apple


milk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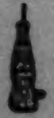
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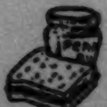
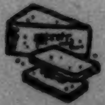
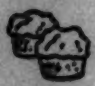
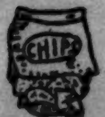

peanut butter sandwich


cheese


bran muffin



potato chips

GRADE 2 QUESTIONNAIRE

Items used for the knowledge score:

ITEM NUMBER	BLOOM'S CATEGORY	POINT VALUE	MAXIMUM SCORE
4	Knowledge	1	14
5	Knowledge	3	
6	Comprehension	4	
7	Comprehension	2	
8	Comprehension	4	

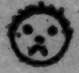
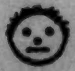
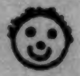
Name ______________________________
(First) (Last)

GRADE 2

(The teacher is requested to read each question over with the students. Please give help interpreting pictures only where there are labels.)

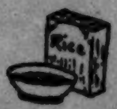
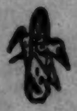
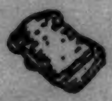
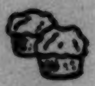
1. If Captain Nutrition were a cartoon, would you watch it? Yes ______
No ______

2. Do you like to learn about food? Draw an X on one face.

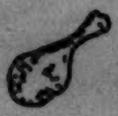
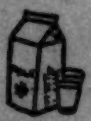
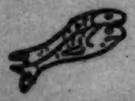
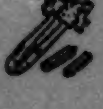
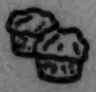
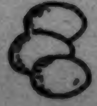




3. How often do you eat chocolate bars and candy?
every day ______
2 or 3 times a week ______
once a month ______
not at all ______

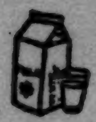
4. Circle the food that does not belong with the others.

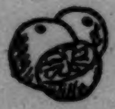





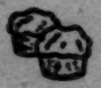
5. Circle all foods in the meat or meat alternate group.

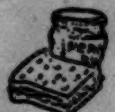







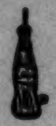
6. Circle 4 foods that would make a lunch that is good for you.

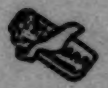

milk

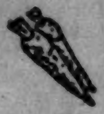

orange

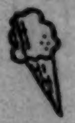

bran muffin

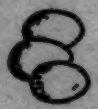

peanut butter sandwich


pop

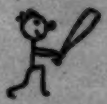

chocolate bar

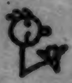

carrots

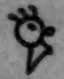

ice cream

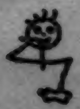

eggs

7. Circle all the children who are doing something that makes them healthy.

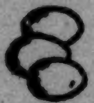

playing baseball

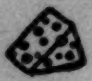

eating a banana

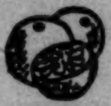

chewing a pencil

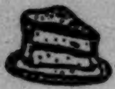

brushing teeth

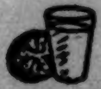
8. Circle 4 foods that make a breakfast that is good for you.

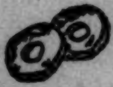

eggs

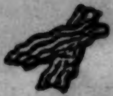

cheese

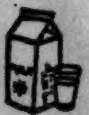

grapefruit

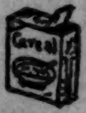

cake


orange juice

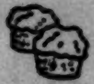

doughnuts

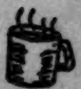

bacon

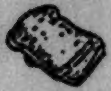

milk



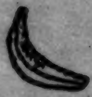
cereal

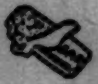

bran muffin

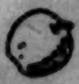

hot chocolate

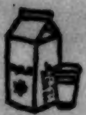

toast

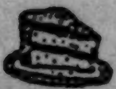
9. Draw an X on the snacks you eat after school.

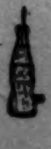

banana

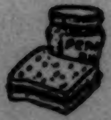

chocolate bar

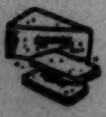

apple

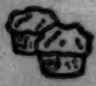

milk

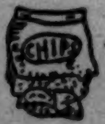

cake


pop


peanut butter sandwich


cheese


bran muffin



potato chips

GRADE 3 QUESTIONNAIRE

Items used for the knowledge score:

ITEM NUMBER	BLOOM'S CATEGORY	POINT VALUE	MAXIMUM SCORE
4	Comprehension	2	14
5	Knowledge	1	
6	Comprehension	4	
8	Comprehension	4	
9	Knowledge	3	

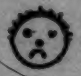
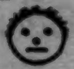
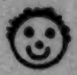
Name ______________________________
(First) (Last)

GRADE 3

(The teacher is asked to read each question over with the students. Please give help interpreting pictures only where there are labels.)

1. If there were a comic book called, "CAPTAIN NUTS IN NUTRITION LAND", would you read it? Yes ______
No ______

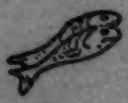
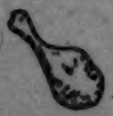
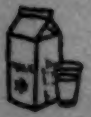
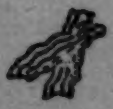
2. Do you like to know what you body does with the food you eat? Draw an X on one face.

3. How often do you eat chocolate bars and candy?
every day ________
2 or 3 times a week ________
once a month ________
not at all ________

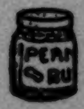
4. Why do you need good food?
a. to be healthy and grow ______
b. to be happy ______
c. to have energy ______
d. it does not matter what you eat ______

5. Circle the food that does not belong with the others.

6. Circle 4 foods that would make a lunch that is good for you.

pop



peanut butter

oatmeal cookies

apple

bread

eggs

chocolate bar

yogurt

orange

milk

potato chips

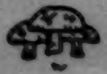
bran muffin

7. Circle all the vegetables you like to eat.

corn

lettuce

carrot


mushrooms

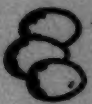
onion

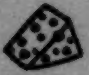
tomato

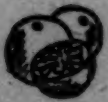
celery
sticks

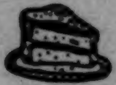
turnip
sticks

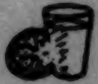
8. Circle 4 foods that make a breakfast that is good for you.

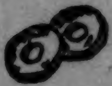

eggs

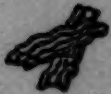

cheese

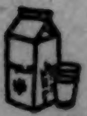

grapefruit

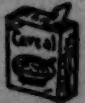

cake

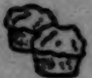

orange juice

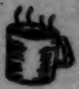

doughnut

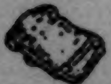

bacon


milk

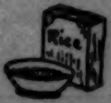

cereal

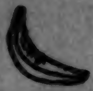

bran muffin

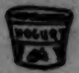

hot
chocolate

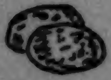

toast

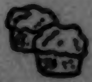
9. Circle all the foods in the bread and cereal group.

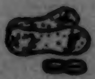

rice

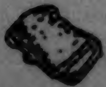

banana

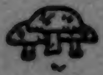

yogurt


potatoes


bran muffin


nuts


toast


mushrooms

GRADE 4 QUESTIONNAIRE

Items used for the knowledge score:

ITEM NUMBER	BLOOM'S CATEGORY	POINT VALUE	MAXIMUM SCORE
4	Knowledge	1	17
6	Comprehension	1	
7	Knowledge	1	
9	Comprehension	2	
10	Application	12	

Name ____
(First) (Last)

GRADE 4

READ EACH QUESTION. CHECK (✓) ONE ANSWER.

(The teacher is asked to read each question over with the students.)

1. Would you read a comic about "Captain Nuts in Nutrition Land?"

   yes ______
   maybe ______
   no ______

2. If I know a food is nutritious, I will usually eat it ______
   I may eat it ______
   I won't eat it ______

3. How do you usually spend snack money?

   pop ______
   candy ______
   fruit ______
   milk ______
   or ______________________________ (fill in)

4. Which food contains fat?

   a. apple ______
   b. potato ______
   c. cheese ______
   d. banana ______

5. How many times do you eat fresh fruit each week?

   a. 0 to 5 times ______
   b. 6 to 10 times ______
   c. 11 times or more ______

6. Which is most important to help body cells to grow?
   - a. water ______
   - b. protein ______
   - c. fat ______

7. Which food group is the best place to get carbohydrates?
   - a. fruit and vegetables ______
   - b. bread and cereals ______
   - c. meat ______
   - d. milk ______

8. When are you most careful in choosing foods that are nutritious?
   - a. when I am at home _____
   - b. when I am at school _____
   - c. all the time _____
   - d. never, I eat what I like _____

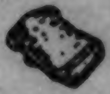
9. Runners need more carbohydrate than artists because ____________________

____

____.

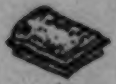
10. Suppose you are choosing the food for one day to meet your daily needs. Choose from the list below. You may choose the same food more than once. You may leave out some of the foods.

potatoes


toast

roast beef

apple


bologna sandwich

ice cream

orange juice

rice

hot chocolate

vegetable salad

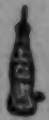
cereal

milk

cake

carrots

pork chops


pop

grapefruit

yogurt

peanut butter sandwich

cheese

scrambled eggs

bread

doughnuts

Write the foods you select on the lines below - one food per line.

Breakfast	Lunch	Dinner	Snacks
________	________	________	________
________	________	________	________
________	________	________	________
________	________	________	________
		________	

GRADE 5 QUESTIONNAIRE

Items used for the knowledge score:

ITEM NUMBER	BLOOM'S CATEGORY	POINT VALUE	MAXIMUM SCORE
3	Knowledge	1	17
4	Knowledge	1	
5	Comprehension	1	
9	Comprehension	2	
10	Application	12	

Name ______________________________
(First) (Last)

GRADE 5

READ EACH QUESTION. CHECK (✓) ONE ANSWER.

(The teacher is asked to read each question over with the students.)

1. If I know a food is nutritious, I will usually eat it _____
I may eat it _____
I won't eat it _____

2. How do you usually spend snack money? pop _____
candy _____
fruit _____
milk _____
or _______________
(fill in)

3. Which food contains protein? a. carrot _____
b. nuts _____
c. orange _____
d. apple _____

4. Which food group is the best place to get: Vitamin A and Vitamin C?
a. milk _____
b. meat _____
c. bread and cereals _____
d. fruit and vegetables _____

5. What nutrient helps build and maintain strong muscles?
a. protein _____
b. carbohydrate _____
c. calcium _____

6. How many times do you eat fresh fruit each week?

   a. 0 to 5 times ______
   b. 6 - 10 times ______
   c. 11 times or more ______

7. When are you most careful in choosing foods that are nutritious?

   a. when I am at home _____
   b. when I am at school _____
   c. all the time _____
   d. never, I eat what I like _____

8. Suppose a radio ad comes on that talks about food that is nutritious.

   Would you a. listen ______
   b. stop listening ______
   c. change stations ______

9. People who go camping outdoors in winter need to eat lots of carbohydrate because ____
____
____

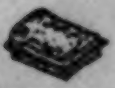
10. Suppose you are choosing the food for one day to meet your daily needs. Choose from the list below. You may choose the same food more than once. You may leave out some of the foods.

potatoes

toast

roast beef

apple


bologna sandwich

ice cream

orange juice

rice

hot chocolate

vegetable salad

cereal

milk

cake

carrots

pork chops

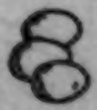
pop

grapefruit

yogurt

peanut butter sandwich

cheese


scrambled eggs

bread

doughnuts

Write the foods you select on the lines below - one food per line.

Breakfast	Lunch	Dinner	Snacks

GRADE 6 QUESTIONNAIRE

Items used for the knowledge score:

ITEM NUMBER	BLOOM'S CATEGORY	POINT VALUE	MAXIMUM SCORE
5	Knowledge	1	17
6	Comprehension	1	
10	Knowledge	1	
11	Comprehension	2	
12	Application	12	

Name ______________________________
(First) (Last)

GRADE 6

READ EACH QUESTION. CHECK (✓) ONE ANSWER.

(The teacher is asked to read each question over with the students.)

1. "I may know what I should eat. BUT it is too difficult to change my way of eating." Do you
   agree _____
   disagree _____

2. MY EATING HABITS.
   a. I don't need to improve them _____
   b. I don't want to improve them _____
   c. I do want to improve them _____

3. If I know a food is nutritious,
   a. I will usually eat it _____
   b. I may eat it _____
   c. I won't eat it _____

4. What do you usually buy for a snack?
   fruit _____
   potato chips or candy _____
   pop _____
   milk _____
   or ______________________
   (fill in)

5. Which food contains sugar?
   a. potato _____
   b. apple _____
   c. nuts _____
   d. cheese _____

6. What nutrient helps build and maintain strong muscles?
   a. protein _____
   b. carbohydrate _____
   c. calcium _____

7. Suppose a radio ad comes on that talks about food that is nutritious.

Would you:
- a. listen _______
- b. stop listening _______
- c. change stations ________

8. How many times do you eat fresh fruit each week?
- a. 0 to 5 times _____
- b. 6 to 10 times ______
- c. 11 times or more ______

9. When are you most careful in choosing foods that are nutritious?
- a. when I am at home ______
- b. when I am at school ______
- c. all the time ______
- d. never, I eat what I like ______

FILL IN THE BLANKS.

10. Which food group is the best place to get: Carbohydrate, Iron and B-vitamins? ___________________________

11. A skier should eat lots of carbohydrate because ______________________

____

____

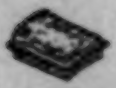
12. Suppose you are choosing the food for one day to meet your daily needs. Choose from the list below. You may choose the same food more than once. You may leave out some of the foods.

potatoes

toast

roast beef

apple


bologna sandwich

ice cream

orange juice

rice

hot chocolate

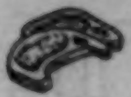
vegetable salad

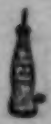
cereal

milk

cake

carrots


pork chops

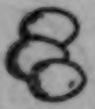

pop

grapefruit

yogurt

peanut butter sandwich

cheese


scrambled eggs

bread

doughnuts

Write the foods you select on the lines below - one food per line.

Breakfast	Lunch	Dinner	Snacks

APPENDIX B

POSTTEST QUESTIONNAIRES

GRADE 1 QUESTIONNAIRE

Items used for the knowledge score:

ITEM NUMBER	BLOOM'S CATEGORY	POINT VALUE	MAXIMUM SCORE
3	Knowledge	2	12
4	Comprehension	4	
5	Comprehension	2	
6	Comprehension	4	

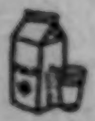
Name ______________________________
(First) (Last)

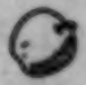
GRADE I

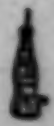
The teacher is requested to read each question to the students. Please give help interpreting pictures only where there are labels.

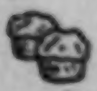
Ask students to stop when they come to each line until given directions to go on to the next question.

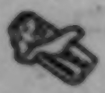
1. Draw an X on the foods you like to eat.

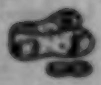

milk

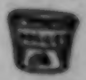

apple

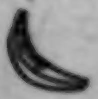

pop

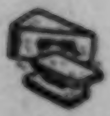

bran muffin


chocolate bar


nuts


yogurt


banana


cheese

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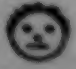
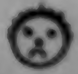
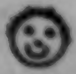
2. Draw an X on the face that shows how you feel when you are learning about food.







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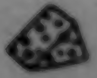
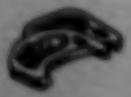
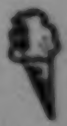
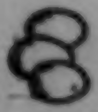
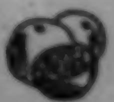
3. Draw an X on all the foods that have milk in them.



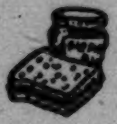


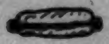


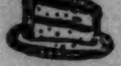


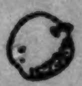


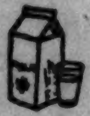
4. Draw an X on 3 foods that make a lunch that is good for you.

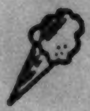

peanut butter sandwich

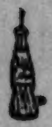

hotdog

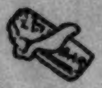

cake

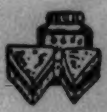

apple


milk


ice cream


pop


chocolate bar


jam sandwich

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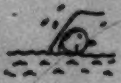
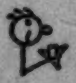
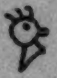
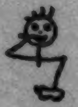
5. Draw an X on all the children who are doing something that makes them healthy.


swimming

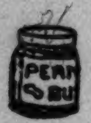

eating a banana


chewing a pencil


brushing teeth

6. Draw an X on 4 foods that make a breakfast that is good for you.

eggs


peanut butter

grapefruit

cake

orange juice

doughnuts

bacon

milk

cereal

bran muffin

hot chocolate

toast

---

7. Draw an X on the snacks you eat after school.

banana

chocolate bar

apple

milk

cake

pop

peanut butter sandwich

cheese

bran muffin

potato chips

GRADE 2 QUESTIONNAIRE

Items used for the knowledge score:

ITEM NUMBER	BLOOM'S CATEGORY	POINT VALUE	MAXIMUM SCORE
4	Knowledge	1	14
5	Knowledge	3	
6	Comprehension	4	
7	Comprehension	2	
8	Comprehension	4	

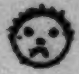
Name ________________________
(First) (Last)

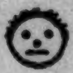
GRADE 2

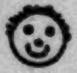
(The teacher is requested to read each question over with the students. Please give help interpreting pictures only where there are labels.)

1. If Captain Nutrition were a cartoon, would you watch it?
Yes ______
No ______

2. Do you like to learn about food? Draw an X on one face.

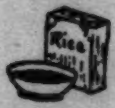


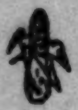


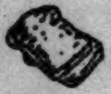


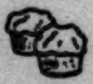
3. How often do you eat chocolate bars and candy?
every day ______
2 or 3 times a week ______
once a month ______
not at all ______

4. Circle the food that does not belong with the others.

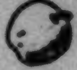


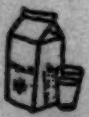


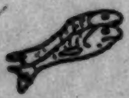


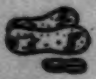


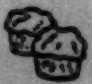
5. Circle all foods in the meat or meat alternate group.

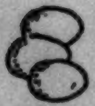




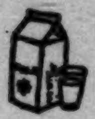




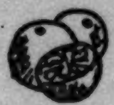




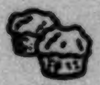
6. Circle 4 foods that would make a lunch that is good for you.



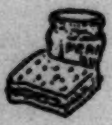
milk



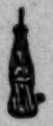
orange



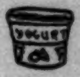
bran muffin



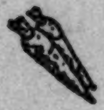
peanut butter sandwich



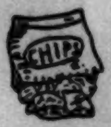
pop



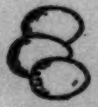
yogurt



carrots

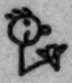


potato chips

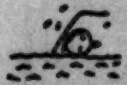


eggs

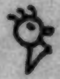
7. Circle all the children who are doing something that makes them healthy.



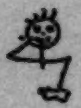
eating a banana



swimming



chewing a pencil



brushing teeth

8. Circle 4 foods that make a breakfast that is good for you.

eggs

peanut butter

grapefruit

cake

orange juice

doughnuts

bacon

milk

cereal

bran muffin

hot chocolate

toast

9. Draw an X on the snacks you eat after school.

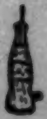
banana

chocolate bar

apple

milk

cake


pop

peanut butter sandwich

cheese

bran muffin

potato chips

GRADE 3 QUESTIONNAIRE

Items used for the knowledge score:

ITEM NUMBER	BLOOM'S CATEGORY	POINT VALUE	MAXIMUM SCORE
4	Comprehension	2	14
5	Knowledge	1	
6	Comprehension	4	
8	Comprehension	4	
9	Knowledge	3	

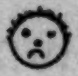
Name ____
(First) (Last)

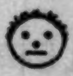
GRADE 3

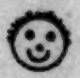
(The teacher is asked to read each question over with the students. Please give help interpreting pictures only where there are labels.)

1. If there were a comic book called, "CAPTAIN NUTS IN NUTRITION LAND", would you read it? Yes _____
No _____

2. Do you like to know what you body does with the food you eat? Draw an X on one face.



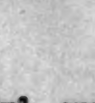




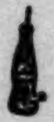
3. How often do you eat chocolate bars and candy?
every day _______
2 or 3 times a week _______
once a month _______
not at all _______

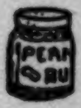
4. Why do you need good food?
a. to be healthy and grow _____
b. to be happy _____
c. to have energy _____
d. it does not matter what you eat _____

5. Circle the food that does not belong with the others.

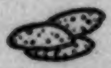


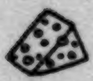
6. Circle 4 foods that would make a lunch that is good for you.

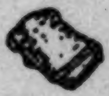

pop

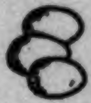


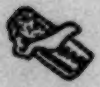
peanut butter

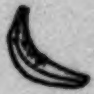

oatmeal cookies

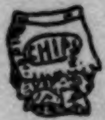

cheese


bread

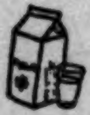

eggs

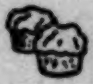

chocolate bar

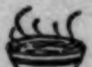

banana



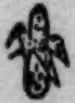
potato chips

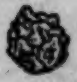

milk

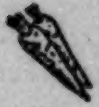

bran muffin

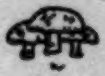

vegetable soup

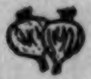
7. Circle all the vegetables you like to eat.

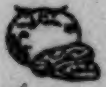

corn

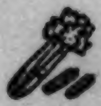

lettuce

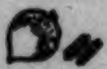

carrot


mushrooms

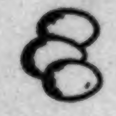

onion

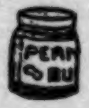

tomato

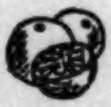

celery
sticks

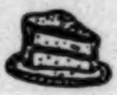

turnip
sticks

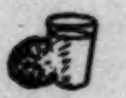
8. Circle 4 foods that make a breakfast that is good for you.

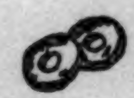

eggs

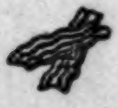

peanut butter

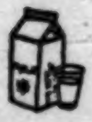

grapefruit

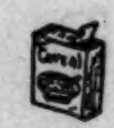

cake

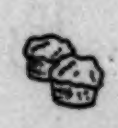

orange juice

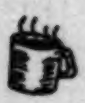

doughnut

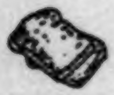

bacon


milk

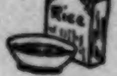

cereal

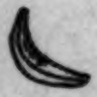

bran muffin

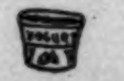

hot chocolate

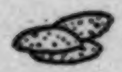

toast

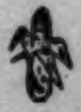
9. Circle all the foods in the bread and cereal group.

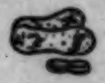

rice

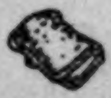

banana

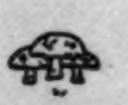

yogurt


oatmeal cookies


corn


nuts


toast


mushrooms

GRADE 4 QUESTIONNAIRE

Items used for the knowledge score:

ITEM NUMBER	BLOOM'S CATEGORY	POINT VALUE	MAXIMUM SCORE
4	Knowledge	1	17
6	Comprehension	1	
9	Comprehension	2	
10	Knowledge	1	
11	Application	12	

Name ______________________________
(First) (Last)

GRADE 4

READ EACH QUESTION. CHECK (✓) ONE ANSWER.

(The teacher is asked to read each question over with the students.)

1. Would you read a comic about "Captain Nuts in Nutrition Land?"

yes _____
maybe _____
no _____

2. If I know a food is nutritious, I will usually eat it _______
I may eat it ______
I won't eat it ______

3. How do you usually spend snack money?

pop ______
candy ______
fruit ______
milk ______
or ___________________________ (fill in)

4. Which food contains protein?

a. carrot ________
b. nuts ________
c. orange ________
d. apple ________

5. How many times do you eat fresh fruit each week?

a. 0 to 5 times ______
b. 6 to 10 times ______
c. 11 times or more ______

6. Which vitamin is important for healthy gums and teeth?

   a. Vitamin A _____

   b. Vitamin B _____

   c. Vitamin C _____

   d. Vitamin D _____

7. Have you learned to like any new foods since this new year has begun?

   Yes _____

   No _____

   If yes, which ones? ______________________________

   ____

8. When are you most careful in choosing foods that are nutritious?

   a. when I am at home _____

   b. when I am at school _____

   c. all the time _____

   d. never, I eat what I like _____

9. Runners need more carbohydrate than artists because ______________

   ____

   ____

10. Which food group is the best place to get calcium, protein, and riboflavin?

    a. fruit and vegetables _____

    b. bread and cereals _____

    c. meat _____

    d. milk _____

11. Suppose you are choosing the food for one day to meet your daily needs. Choose from the list below. You may choose the same food more than once. You may leave out some of the foods.

potatoes

toast

roast beef

apple

vegetable soup

ice cream

orange juice

rice

hot chocolate

vegetable salad

cereal

milk

cake

fish

jam sandwich

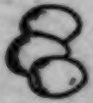
pop

grapefruit

yogurt

peanut butter sandwich

cheese


scrambled eggs

bread

hot dog

Write the foods you select on the lines below - one food per line.

Breakfast	Lunch	Dinner	Snacks

GRADE 5 QUESTIONNAIRE

Items used for the knowledge score:

ITEM NUMBER	BLOOM'S CATEGORY	POINT VALUE	MAXIMUM SCORE
3	Knowledge	1	17
4	Comprehension	1	
5	Comprehension	2	
10	Knowledge	1	
11	Application	12	

Name ______________________________
(First) (Last)

GRADE 5

READ EACH QUESTION. CHECK (✓) ONE ANSWER.

(The Teacher is asked to read each question over with the students.)

1. If I know a food is nutritious, I will usually eat it _____
   I may eat it _____
   I won't eat it _____

2. How do you usually spend snack money? pop _____
   candy _____
   fruit _____
   milk _____
   or ____________________
   (fill in)

3. Which food contains sugar?
   a. potato _____
   b. apple _____
   c. nuts _____
   d. cheese _____

4. Which vitamin is important for healthy gums and teeth? Vitamin A _____
   Vitamin B _____
   Vitamin C _____
   Vitamin D _____

5. If you are getting enough calories in your food during the day, are you sure to be getting enough protein, vitamins, and other nutrients?

   Yes ____
   No ____

   Why or why not? ______________________________
   ____

6. How many times do you eat fresh fruit each week?

a. 0 to 5 times _____

b. 6 to 10 times _____

c. 11 times or more _____

7. When are you most careful in choosing foods that are nutritious?

a. when I am at home _____

b. when I am at school ____

c. all the time _____

d. never, I eat what I like _____

8. Have you learned to like any new foods since this new year has begun?

Yes ____

No ____

If so, which ones? ____

____

9. Suppose a radio ad comes on that talks about food that is nutritious. Would you:

a. listen _____

b. stop listening ____

c. change stations _____

10. Which food group is the best place to get: Carbohydrate, Iron and B-vitamins? ____________________________

11. **Suppose you are choosing the food for one day to meet your daily needs. Choose from the list below. You may choose the same food more than once. You may leave out some of the foods.**

potatoes

toast

roast beef

apple

vegetable soup

ice cream

orange juice

rice

hot chocolate

vegetable salad

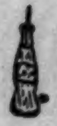
cereal

milk

cake

fish

jam sandwich


pop

grapefruit

yogurt

peanut butter sandwich

cheese

scrambled eggs

bread

hot dog

Write the foods you select on the lines below - one food per line.

Breakfast	Lunch	Dinner	Snacks

GRADE 6 QUESTIONNAIRE

Items used for the knowledge score:

ITEM NUMBER	BLOOM'S CATEGORY	POINT VALUE	MAXIMUM SCORE
5	Knowledge	1	17
6	Knowledge	1	
11	Comprehension	2	
12*	Comprehension	1	
13	Application	12	

* This item was omitted from posttest questionnaire. For this reason, posttest Raw Scores for all grade 6 students were adjusted by adding 1 point to their maximum raw scores.

Name ______________________________
(First) (Last)

GRADE 6

READ EACH QUESTION. CHECK (✓) ONE ANSWER.

(The teacher is asked to read each question over with the students.)

1. "I may know what I should eat. BUT it is too difficult to change my way of eating." Do you
   - agree _____
   - disagree _____

2. MY EATING HABITS.
   - a. I don't need to improve them _____
   - b. I don't want to improve them _____
   - c. I do want to improve them _____

3. If I know a food is nutritious,
   - a. I will usually eat it _____
   - b. I may eat it _____
   - c. I won't eat it _____

4. What do you usually buy for a snack?
   - fruit _____
   - potato chips or candy _____
   - pop _____
   - milk _____
   - or ____________________ (fill in)

5. Which food contains fat ?
   - a. apple _____
   - b. potato _____
   - c. cheese _____
   - d. banana _____

6. Which food group is the best place to get: Vitamin A and Vitamin C?
   - a. milk _____
   - b. meat _____
   - c. bread and cereals _____
   - d. fruit and vegetables _____

7. Suppose a radio ad comes on that talks about food that is nutritious.

Would you:
   a. listen _________
   b. stop listening ______
   c. change stations ______

8. How many times do you eat fresh fruit each week?
   a. 0 to 5 times _____
   b. 6 to 10 times _____
   c. 11 times or more _____

9. When are you most careful in choosing foods that are nutritious?
   a. when I am at home _____
   b. when I am at School _____
   c. all the time _____
   d. never, I eat what I like _____

10. Have you learned to like any new foods since this new year has begun?

Yes _____

No._____

If so, which ones? ____

____

11. If you are getting enough calories in your food during the day, are you sure to be getting enough protein, vitamins, and other nutrients?

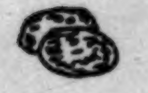
Yes _____

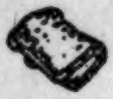
No _____

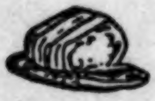
Why or why not ____

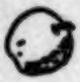
____

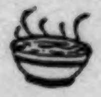
13. Suppose you are choosing the food for one day to meet your daily needs. Choose from the list below. You may choose the same food more than once. You may leave out some of the foods.

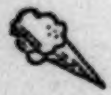

potatoes

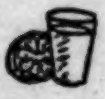

toast

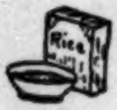

roast beef

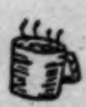

apple

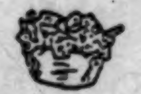

vegetable soup

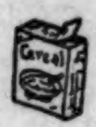

ice cream

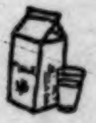

orange juice

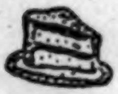

rice

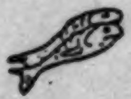

hot chocolate

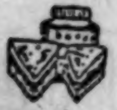

vegetable salad

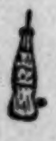

cereal

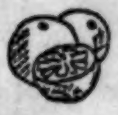

milk

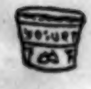

cake

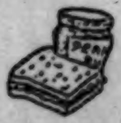

fish

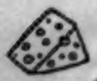

jam sandwich

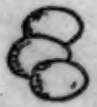

pop

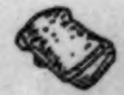

grapefruit

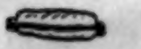

yogurt


peanut butter sandwich


cheese


scrambled eggs


bread


hot dog

Write the foods you select on the lines below - one food per line.

Breakfast Lunch Dinner Snacks

APPENDIX C

MEANS AND STANDARD DEVIATIONS FOR PRE- AND POSTTEST SCORES

TABLE 17

SUMMARY OF MEANS AND STANDARD DEVIATIONS FOR PRE- AND POSTTESTS (GRADES 1 TO 3)

GRADE	GROUP*	N	PRETEST		POSTTEST	
			$\bar{X}$	STD	$\bar{X}$	STD
GRADE 1						
Raw Score	A	40	8.9	2.05	9.7	1.49
	B	40	8.8	1.74	9.2	1.37
	C	40	9.0	1.80	9.2	1.59
Equalized Score	A	40	8.9	1.76	9.7	1.51
	B	40	8.9	1.69	9.3	1.43
	C	40	8.9	1.61	9.1	1.59
GRADE 2						
Raw Score	A	60	9.7	1.53	10.7	1.86
	B	30	9.6	1.10	9.9	1.60
	C	20	10.7	1.03	9.3	1.41
Equalized Score	A	60	9.9	1.10	10.9	2.00
	B	30	9.9	1.01	10.2	1.50
	C	20	9.9	1.03	8.5	1.48
GRADE 3						
Raw Score	A	50	9.9	1.43	10.4	1.49
	B	35	10.5	1.56	9.4	1.60
	C	38	9.6	1.67	9.3	1.71
Equalized Score	A	50	10.0	1.37	10.5	1.63
	B	35	10.0	1.52	8.9	1.55
	C	38	10.0	1.53	9.7	1.56

* A = Nutrition Education Plus Food Samples
B = Intensively Resourced Nutrition Education
C = Control

TABLE 18

SUMMARY OF MEANS AND STANDARD DEVIATIONS FOR PRE- AND POSTTESTS (GRADES 4 TO 6)

GRADE	GROUP*	N	PRETEST		POSTTEST	
			$\bar{X}$	STD	$\bar{X}$	STD
GRADE 4						
Raw Score	A	60	12.1	2.60	12.6	1.96
	B	40	12.2	1.80	11.5	1.54
	C	34	12.4	2.03	10.8	1.79
Equalized Score	A	60	12.1	2.17	12.7	1.97
	B	40	12.1	1.73	11.4	1.62
	C	34	12.1	1.95	10.5	1.89
GRADE 5						
Raw Score	A	50	11.3	1.71	12.0	1.96
	B	30	11.6	2.40	11.5	1.74
	C	50	11.5	1.91	11.6	1.95
Equalized Score	A	50	11.4	1.69	12.1	2.02
	B	30	11.4	1.96	11.3	1.45
	C	50	11.4	1.56	11.5	1.96
GRADE 6						
Raw Score	A	60	11.3	2.25	13.1	2.49
	B	30	11.6	1.38	11.8	2.25
	C	50	11.4	2.16	12.6	2.22
Equalized Score	A	60	11.4	2.13	13.2	2.60
	B	30	11.4	1.35	11.6	2.19
	C	50	11.4	1.94	12.5	2.31

* A = Nutrition Education Plus Food Samples
B = Intensively Resourced Nutrition Education
C = Control